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U.S. MILITARY TRANSFORMATION AND EXPERIMENTATION

HISTORICAL PERSPECTIVES, PROSPECTS, AND PRESCRIPTION

By

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Preface

My interest in military transformation and experimentation grew primarily from my experiences at the Pentagon beginning in 1997. At that time I was an Air Force action officer assigned to the Joint Staff's effort to implement Joint Vision 2010 (JV2010). It was a terribly frustrating experience. We struggled with questions such as: "What is dominant maneuver?" Just as we were completing the Air Force-wide effort of developing Desired Operational Capabilities in support of the Chairman's vision, I was also tasked with coordinating the Air Force inputs to the Commander-in-Chief Atlantic Command's (CINCACOM) charter as DOD lead for "Joint Experimentation" (JE). At that time JE was (and perhaps still is) viewed as potentially quite threatening to Service Title X responsibilities and Service roles and missions. As a result of that experience, I became fascinated with the potential of military experimentation for change—a promise that most observers perceive as unfulfilled.

Military experimentation is not new, yet few had any knowledge of its past or had time to seriously research the subject. Thanks in part to sponsorship from Andy Marshal, Director of the Office of Net Assessment, many books and papers have been written that describe and interpret various factors that either have contributed to, or failed to contribute to, past transformations of military capabilities. These works were largely written by historians and not by today's uniformed military officers caught in the day-to-day struggle to effect change.

This paper explores the most critical similarities and dissimilarities from arguably the two most successful military transformations during the "interwar" years (1919-1939): German

"Blitzkrieg" and U.S. Navy carrier operations. Within the resulting framework of past these two successes, it then analyzes the prospect for U.S. transformation within current processes, policies, and institutional arrangements. From that analysis, it offers a historically based set of recommendations for the senior leaders to consider in their efforts to achieve the next U.S. military transformation.

I am indebted to my loving family for their understanding and patience during the course of this research. I am sincerely grateful to Dr. Goldstein, Professor at the Ridgeway Center of International Security Studies, for his superb insights and strategic guidance. I thank all those who gave so generously of their time and expertise in providing interviews and superb comments during the draft review.

Abstract

Despite the mandates of a rapidly changing world, the U.S. military today is still dominated by Cold-war era weaponry, organizational hierarchies, doctrine, and planning based on the expectation of massive Soviet-style land warfare. Nevertheless, one thing is absolutely certain: *a U.S. military transformation will occur*. The real issues are when, how, and with what consequences.

Two historical cases most dramatically represent successful responses to the WWI-WWII interwar challenge: German combined arms armored maneuver warfare (colloquially known as "Blitzkrieg") and American aircraft carrier battle group operations. Despite their differing strategic perspectives, these two cases (widely studied—but not exclusively and directly compared) share a striking number of significant common characteristics—many of which were lacking in other militaries that failed. The critical common elements of these two institutions (the German Army and the U.S. Navy) form a blueprint or framework from which to evaluate current U.S. institutions, and ultimately a historic basis for recommendations for change. These common characteristics are:

Visions/Visionary leaders (persistent tenure)

Pressing national security concern

Detailed, systematic study and analysis of others' military experiments and ideas

Decades to develop (recognition that it will take time)

At least a modicum of outside (civilian) influence and assistance

An environment or culture genuinely open to new operational concepts

Extensive experimentation and wargaming without a single major system prototype

Extremely realistic experimentation grounded in detailed analysis and focused on solving

specific problems and exploring operational concepts

Large-scale, live-force, annual events utilizing available forces whose purpose was both training and experimentation

Experiments were not single events

Strong institutional and conceptual linkages between wargaming and exercises

Carefully documented in reports that were widely circulated

Extensive senior-level involvement

Extensive employment of live opposition forces (red teaming) that frequently outnumbered "good guys"

Field exercises and Fleet Problems were as closely as possible tied to the real world

Experiments that failed

History's lesson is that the present "tornado" of activity within the Department of Defense (DOD) is unlikely to produce a genuine military transformation without the overarching guidance and the forcing mechanisms necessary to achieve it. What is needed are top-down direction from the Secretary of Defense (SecDef) to focus the full range of DOD activities on a well-defined set of at most two or three challenges. Additionally, Joint Forces Command (JFCOM) and even the Services are free to experiment anyway they desire. The primary problem with this current laze faire approach is that military experiments don't occur in an institutional vacuum.

Given its central role in the transformation process, and given the diversity and number of experimentation activities, the DOD should establish a comprehensive framework for large-scale Joint and Service experimentation. The only way to achieve credible results is to conduct

realistic trials with live forces under a variety of conditions. Motives for experimentation should be guided by a SecDef vision (specific prioritized operational challenges and sub-challenges) with direct linkages to wargaming. Because of the importance of experimentation, sufficient resources must be allocated, even if it means some reduction in the current readiness of forces. The DOD is already 12 years into the current interwar period—it is time to put in place a proven process for experimentation and a framework for genuine transformation.

Chapter 1

Historical Perspectives

Actions speak louder than words. In the days to come the Goddess of Victory will bestow her laurels only on those who are prepared to act with daring.

—Heinz Guderian

Mandate for Transformation

One constant of human history is institutional change. This is no less true for military institutions as it is for governmental, corporate, and legal ones. Military institutions, however, face a unique challenge in balancing the need for a disciplined acceptance of doctrine and authority demanded by the uniqueness of their profession on one hand and addressing new technological, social-economic, and geo-strategic realities on the other. How past military institutions have overcome, or failed to overcome, this challenge can yield important insights for senior leaders of the U.S. military as they attempt to stimulate and focus the process of adaptation and innovation in pursuit of a genuine transformation. ver the past 1000 years or so, there have been at least 12 successful instances of military transformation.[1] These cases of historic transformation begin with the Mongol employment of mounted archers and siege mechanics and end with the U.S.-led information-based collapse of spatial and temporal command and control restrictions combined with stealth and precision strike first demonstrated during the Persian Gulf War.

Two broad observations can be made with regard to this 1000-year period. First, military transformation occurrence has been rapidly accelerating with 5 of the 12 instances occurring in

just the last 150 years (steam and rapid mobilization; machine gun and trench warfare; internal combustion, radio, and mobility; nuclear; and information). The second observation is a significant decline in the amount of time that the transformed forces had to enjoy enjoyed the distinct advantages wrought by their shift in warfare. For example, the Mongols maintained their monopoly about 50 years (and created the largest land empire in the history of man), and the British held its infantry revolution advantage about 60 years. Whereas the Germans held their advantage in mobile armored warfare only two years and the United States held its nuclear weapons monopoly only four.[2] It is also worth noting that shifts in the conduct of warfare have not been a steady and continuous process (although the lessons of the previous transformations were not lost), but rather tend to occur erratically. Before examining two cases of relatively recent transformations, it is important to clarify three definitions.

Innovation, Transformation, and Revolutions in Military Affairs

Three terms that have been widely used throughout the DOD have evolved to mean different things to different people are: innovation, transformation, and revolutions in military affairs (RMAs).

The term innovation has been defined as "… an active change, to achieve a conscious objective, involving something new."[3] Examples of military innovation would include an incremental increase in effectiveness (or decrease in cost) resulting from a technological, doctrinal, or organizational change.

The term transformation implies a much more sweeping kind of change: "Transformation can be defined as innovation on a grand scale, sufficient to bring about a discontinuous leap in military effectiveness."[4] This definition is more encompassing than that used by Deputy Secretary of Defense (DepSecDef) Wolfowitz in discussing the Department's

pursuit of "… a host of transformations, including precision, surveillance, network communications, robotics, and information processing."[5] Nor is transformation achieved by significant changes in force structure alone. Rather, transformation in the broader sense occurs either from the cumulative effects of a series of innovations or the synergistic effects of a few significant innovations that (for our purposes) *fundamentally alter the conduct of war*.

The term RMA, apparently had its origins in Soviet military theory and was initially termed a "military-technical revolution."[6] The work of Andrew Marshall spawned a large debate in the wake of Desert Storm about the prospects of long-range precision strike and information warfare to create a "combined-systems" revolution in the conduct of warfare resulting from a synergistic fit between new military systems, concepts, doctrine, and organizations.[7] Whether or not the U.S. military has already witnessed, or is on the eve of such a revolution, is not particularly relevant to this paper primarily because RMAs have typically taken decades to develop.[8] Whether or not they should, therefore, be called "revolutionary" is perhaps a matter of perspective. .

Operational Imperatives And Immutable Truths

Much has been written about the rapid and monumental increase in the relative lethality of man—manifest in the contrast between the development of the English long bow and that of nuclear weapons. The advent of the means of even greater lethality in the form of nuclear, improved biological and chemical, and precise short/long-range conventional weapons has been revolutionary in terms of human history. A whole range of new technologies now in their infancy (e.g., nano, genetic, and robotics technologies) may offer further opportunities to advance human destructive potential. The future not only promises to offer new and greater forms of lethality, but also their diffusion to less-stable "Third World" governments and a host of

non-governmental actors.[9]

The recent dramatic increases in technological advancement which have contributed to man's lethality is being matched by rapid technological diffusion fed by new capabilities made possible by information age capabilities and cross-currents of economic globalization. This reality will certainly pose new challenges for mechanisms that have historically maintained global security. Not only are the technologies associated with greater lethality and precision becoming more diffused, their cost has also dramatically decreased, thus fueling an acceleration of proliferation.[10]

Taken together, the combination of these developments has huge implications for the conduct and fundamental characteristics of the next major human conflict. Not only will militaries have to cope with the potential use of new biological weapons, advanced/precise high explosives, and nuclear-related weapons of mass destruction, but these militaries will also have to contend with the dramatic increase in number, range, and especially the accuracy of their means of delivery—primarily theater ballistic and cruise missiles. Faced with overwhelming U.S. military superiority in land, air, and sea power, many countries are pursuing the acquisition of so-called "area-denial" or anti-access weapons to provide strategic deterrents against, to slow, and to increase risks associated with conventional military power projection. Continued pursuit of relatively advanced deeper water mines, wake-homing torpedoes, diesel submarines, air defense systems, special operations, and primitive but effective suicide bomb capabilities by potentially hostile nations and sub-national entities also pose enormous military challenges for current Western power-projection forces, and the challenges won't end there.

Just as the globalization and interneted communications have inexorably led to greater rapidity in the diffusion of lethality, they have and will continue to contribute to widespread

access to relatively advanced and less-expensive sensors that will be located in all mediums (space, air, land, water). While wealthy Western countries currently lead in the development and integration of advanced sensors and associated long-range precision conventional weaponry, potential enemy integration of those sensors via ever-expanding information infrastructures is certain to follow. India now produces over one third of the world's software engineers. China is one of the world's leading producer of internet routers, is the fourth leading producer of microchips, and is building a reserve corps of computer savvy information warriors. As countries continue to mature and develop information infrastructures for commercial applications, potential military competitors could convert them quickly.[11] Given the complex, cumbersome, and long-lead U.S. acquisition process, they even may be able to do so more effectively and economically.[12] How long, and to what extent, will Western militaries maintain their "information integration" edge? What are the effects of chemical, biological, radiological, nuclear, and advanced explosives (CBRNE) proliferation and integration diffusion, and how will they fundamentally alter the conduct of warfare?

Some futurists see an ever-expanding future "battlespace" where detection means almost assured destruction. Others theorize that advantages associated with defensive warfare will once again dominate. This occurred only two other times during the last 1000 years (the dominance of the fortress and trench warfare during most of World War I).[13] Perhaps the opening salvo will be a small nuclear detonation to achieve electromagnetic pulse degradation of critical platforms and datalink processing. Or perhaps victory will not be won by destruction of enemy forces and weapons but rather by the destruction of the sensors used to guide them.[14] Certainly, as the events of September 11th painfully detail, America will continue to become increasingly vulnerable, and the dynamics of deterrence may become radically altered.[15] Whatever shape the

next major war will take, it is clear that it is likely to be radically different than the last one.

Potential adversaries certainly learned much from the last major war (Desert Storm).[16] Nevertheless, current U.S. force structure, associated capabilities, and concepts of operations are explicitly based upon fighting the last war in two separate theaters.[17] This disparity between new world realities, and U.S. force structure and employment planning has spawned a perceived urgency for transformation of U.S. military capabilities, associated concepts of operations, processes, and military posture.

Political Mandate

What began in the early Nineties as a demand from a minority of Congressmen to begin a measured institutionally-driven process of change,[18] grew into a Presidential election campaign pledge to exploit "… a revolution in the technology of war"; and to "… skip a generation of weapon systems that only bring incremental improvements; and to put at least 20 percent of the acquisition budget into futuristic weapons based on mobility, stealth, precision and information-gathering…";[19] and eventually an executive mandate.[20] The Defense Department's own documents have articulated a clear necessity to transform as well.[21] According to the 2001 Quadrennial Defense Review (QDR), "… the Department is committed to undertaking a sustained process of transformation…."[22] In the wake of the September 11th attack, speeches by the SecDef highlight the need to "… prepare to defend our nation against the unknown, uncertain, the unseen and the unexpected."[23] However, SecDef's perspective that the future will hold significant surprises was evident from the beginning of his term and laid the foundation of the administration's rejection of the Clinton administration's two-Major Theater War (MTW) planning construct.[24] Additionally, SecDef in the 2001 QDR has outlined six key transformational goals of the Department:

To protect bases of operation at home and abroad and defeat the threat of chemical, biological, radiological, nuclear, and enhanced high explosive (CBRNE) weapons

Assure information systems in the face of attack and conduct effective information operations

Protect and sustain U.S. forces in distant anti-access and area-denial environments

Deny enemies sanctuary by providing persistent surveillance, tracking, and rapid engagement

Enhance the capability and survivability of space systems

Leverage information technology and innovative concepts to develop interoperable Joint command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR)[25]

The Bush Administration is backing up its call for transformation with a proposed 2003 defense spending budget increase of $48 billion. According to Deputy Secretary Wolfowitz, some 17 percent of the combined planned spending for research, development, testing, and evaluation, and for procurement (roughly $21.1 billion) represents requests for transformational programs.[26] But it is difficult to determine what is and what is not truly transformational. For example, is funding for the Army's new 70-ton field artillery system, Crusader, an integral part of the DOD's transformation?

Despite some selective budget increases for systems with proven relevance in the post-September 11th era such as precision-guided munitions, unmanned aerial vehicles (UAVs), and special forces, the budget also calls for continuation of virtually every major weapon system inherited from Clinton's legacy modernization plans.[27] While it may seem easy to criticize the

current administration for not "skipping a generation," the real enemy of transformation spending are the long-lead acquisition cycles. For example, the major "new" weapon systems being funded, F-22, Joint Strike Fighter, V-22, and others were conceived in the mid-Eighties in response to radically different security challenges and a very different world order.[28]

Despite the mandates, today's reality is that the U.S. military is still characterized by Cold-war era weaponry, organizational hierarchies, doctrine, and planning based on the expectation of massive Soviet-style land warfare.[29] Nevertheless, one thing is absolutely certain: *a U.S. military transformation will occur*. The real issues are when, how, and with what consequences.

Transformational Insights from History

History will not furnish handy recipes to solve the problems of the future.

—Carl von Clausewitz

Before launching into a study of two successful historic military transformations, it is important to recognize that deriving insights from historic analysis is fraught with potential hazards and is, at best, an inexact science. Military transformations are hugely complex phenomena that have resulted from diverse and perhaps unique sets of variables particular to their historic circumstances. Moreover, most have been fostered or made possible by wild cards, unlikely events, or unforeseeable catalysts.[30] Some would argue that only lessons that continue to be repeated throughout various historical circumstances warrant heeding, but even these can be questioned.

Nevertheless, there is value in studying the characteristics of militaries that have been enormously successful in transforming how wars are conducted, as well as those that simply

failed. History can at least suggest some patterns or characteristics that contributed to other military organizations' abilities to innovate and eventually transform. These historical cases can assist today's senior military leaders and decision-makers in analyzing current institutional DOD arrangements and processes. Perhaps more importantly they can also suggest needed changes to improve the prospects of achieving the next U.S. military transformation.

Despite obvious differences, there are many similarities between interwar period of 1918-1939 and today.[31] The interwar period was a time of great strategic and political uncertainty that could be compared to our own Post-Cold war reality. Then, as now, the interwar years were many decades into a new age, the Industrial Age, now the Information Age. As a result, most of the critical tools of WWII were available at the close of WWI including radios, aircraft carriers, tanks, submarines, fighters, and bombers. The only major tools of WWII that did not yet exist were RADAR and nuclear weapons. The real challenge was (and is) to integrate the (new) tools in the most effective manner. Undoubtedly, the problem of successfully integrating new technologies into new organizations, doctrine, and operational concepts will prove to be as challenging as it has been before.

German Combined Armored Warfare and U.S. Navy Carrier Operations

Two historical cases most dramatically represent successful responses to the interwar challenge: German combined arms armored maneuver warfare (colloquially known as "Blitzkrieg"[32]) and American aircraft carrier battle group operations. Despite their differing strategic perspectives, these two cases (widely studied—but not exclusively and directly compared)[33] share a striking number of significant common characteristics, many of which were lacking in nations that failed. Certainly other cases of interwar transformation could be (and have been) compared such as strategic bombing, the creation of Royal Air Force's air defense

system, the development of an effective approach to amphibious warfare, or the evolution of submarine warfare. The German and U.S. Navy cases were chosen here because they represent the highest degree of departure over previous forms of warfare. The significant common characteristics of these two institutions (the German Army and the U.S. Navy) that produced the most dramatic transformations form a blueprint or framework from which to evaluate current U.S. institutions, and ultimately a historic basis for recommendations. Not surprisingly, the resulting framework is similar to, but not the same as, those developed by others that have studied the interwar period.[34]

Visions/Visionary Leaders (with persistent tenure)

One widely-recognized critical ingredient for successful military transformations has been a visionary or group of visionaries, with relatively persistent tenure, that dare to conceive of bold new ways of conducting warfare. According to Steven Rosen's *Winning the Next War*: "Peacetime innovation has been possible when senior military officers with traditional credentials, reacting not to intelligence about the enemy but to a structural change in the security environment, have acted to create a new promotion pathway for junior officers practicing a new way of war."[35] As important as visionary leaders and doctrinal tenants are to successful transformation, it is also noteworthy that history illustrates how faulty or flawed visions of future warfare can persist despite empirical data or even actual combat experience to the contrary.[36]

Certainly successful transformation in German combined armored warfare and U.S. carrier operations depended heavily on a group of visionaries. In the case of the German Army, at least three such visionaries directly contributed to its transformation: General Hans von Seeckt, General Heinz Guderian, and General Ludwig Beck.[37]

Colonel General Hans von Seeckt, Chief of the General Staff (1919-1920) and Commander in Chief of the German Army (1920-1926) laid the foundation for numerous cultural, doctrinal, and organizational changes within the German Army. His vision of warfare specifically rejected the then commonly held "lesson" of WW I—that the defense was a stronger form of warfare. Von Seeckt argued that the real lesson of WWI was the superiority of maneuver over firepower.[38] This led von Seeckt to place a strong emphasis on the detailed integration of combined arms and a high level of tactical mobility made possible through mechanization. This vision was totally consistent with the traditional Prussian emphasis on strategic surprise, broad encirclements and concentration of force at the decisive point.[39] Not surprisingly, critical elements of von Seeckt's perspectives were reflected in the German Army's keystone tactical regulation in 1921 *Leadership and Battle with Combined Arms*.[40]

Where von Seeckt provided overarching vision to focus German thinking and resources, General Heinz Guderian provided the nuts and bolts of the combined arms armored mechanized structure. It was Guderian who conceived of a total motorized armored team consisting of all branches (tanks, infantry, artillery, engineers, signal corps, air corps, air defense, and supply).[41] Each branch would be optimally sized to maximize its contribution, and motorized so as not to hinder the maneuver of tanks. His focus was not specifically only on breaking through enemy defenses, but consistent with von Seeckt's vision, that such breakthroughs would enable deep penetrations into the enemy's rear with strategic results.[42]

General Ludwig Beck served as head of the Truppenamt (name of the army general staff given to disguise its existence under the Treaty of Versailles), and Chief of the Army General Staff, 1933-1938. He not only provided significant doctrinal refinements on the role of armor, manifested in the 1933 release of *Troop Command* (the official statement of Army Doctrine

produced by a committee chaired by Beck),[43] but authorized the creation of the Panzer Divisions based on work done by the general staff that he directed, and results of the 1935 field exercises.[44] While Beck's visionary contributions may have not been radical, his central role is unquestionable.

Similarly, at least three key visionaries played critical roles in the development of U.S. Navy carrier operations: Admiral William S. Sims, Admiral William Moffett, and Admiral Joseph Reeves. The creation of the world's first aircraft carrier was first proposed in 1912 but was rejected by the British admiralty. The gruesome stalemate of WWI created an exploratory impetus to find an alternative. By the end of WWI, the British had a fleet of nearly a dozen aircraft carriers.[45] The Commander of the Atlantic U.S. Fleet during the war, Admiral Sims became President of the Naval War College (NWC) (from 1919-1922) where he became an outspoken advocate of the potential for aircraft carrier operations to revolutionize warfare.[46] In 1919, Sims presciently envisioned that the fast carriers of the future would carry 100 planes and travel 35 knots (he was off by only 10 planes and 2 knots).[47] Sims' position as NWC President not only enabled him to influence the thinking of many Naval officers but also to contribute to the institutionalization of a process of change.

Admiral Moffett became aware of the tremendous potential of aircraft during his combat experience during WWI and became Chief of the Naval Bureau of Aeronautics in 1921, where he served until his death in 1933.[48] Throughout his tenure he championed numerous institutional and technical contributions to Naval aviation, as well as attracted the best and brightest Naval officers and ensured they had a track to senior command.[49] Moffett's bureaucratic effectiveness, tolerance of failure, and commitment to technological achievement proved critical to the Navy's successful transformation.

Admiral Reeves, like Moffett and Sims, was a former battleship commander whose vision and pioneering led to several important innovations. Armed with insights from the Naval War College (such as maximizing the number of airborne aircraft as the key measure of effectiveness for carrier operations), he invented the airplane movable deck carrier (which facilitated deck parking operations). He also commanded the carrier U.S.S. *Saratoga* and pioneered carrier attack operations during several key fleet exercises (known as Fleet Problems).[50] Reeves is also credited with first envisioning, in detail, the kind of direct attack on enemy land-based operations that became Pearl Harbor.[51]

Vision Responsive to Pressing National Security Concern

Another striking similarity between the Germans and the U.S. Navy is that their respective transformations represented a response to each nation's most pressing national security concern. The Germans initially pursued combined offensive armored warfare as a means to defeat armored offensives by their two most formidable continental enemies, Poland and France.[52] As a result of Germany's geo-strategic position, the Germans were preoccupied with the possibility of a two-front continental land war. Germany was of course constrained from fielding all the traditional weapons of war (including tanks, submarines, and military aircraft) by the Versailles Treaty following WWI. In 1923 the French occupied the Ruhr. The Germans protested but its military was powerless.[53] This vulnerability generated a singularity of purpose and not only focused the German Army's efforts, it also provided an understandable sense of urgency.

The U.S. Navy was primarily concerned with sea control but faced unique challenges, particularly in the Pacific. The tyranny of distance in the Pacific Theater meant that land-based aircraft simply could not provide the requisite level of air support to the fleet. It became clear to

Navy wargamers that the only solution was for the fleets to bring a sufficient amount of airpower with them.[54] Later on, it also became clear that war with Japan was a very real possibility thus providing the U.S. Navy with a sense of urgency.

Detailed Study of Others

Another major similarity between the two historic cases is that both the Germans and the U.S. Navy conducted detailed, systematic studies and analyses of other nations' experiments and military thinking. German officers were encouraged to learn foreign languages and studied the writings of J.F.C. Fuller, Liddell Hart, and Charles DeGualle. They also conducted an exhaustive analysis of British, French, Russian, and even American armies' emerging doctrine, equipment, and operational insights. As early as 1926, the Germans were studying the results of British armored experiments and continued these studies throughout the next decade.[55] For example, some of the documents that survived the war included fully detailed day-by-day accounts of the British armor exercises of 1932.[56] Ironically, they also extracted several important insights from the "failed" British exercises of 1934, which caused many British Army officers to conclude that the potential of armored maneuver warfare had been exaggerated.[57]

The U.S. Navy was initially forced to look to the British for insights into carrier aviation, as they were then the world's pioneers. Under Admiral Sims' guidance, the Naval War College conducted detailed analysis of British carrier operations that ultimately enabled U.S. wargamers to develop several key insights that proved critical to the U.S. Navy's ultimate success.[58] Moreover, the Navy was also critically aware of Japanese carrier developments, which were studied principally in the context of Orange Plan (the U.S. plan to conduct war in the Pacific) development, wargaming, and Fleet Problems.[59]

Decades to Mature

Both transformational cases required decades to develop to a level of maturity sufficient to transform the essential conduct of warfare. In the case of the German Army, its development of combined arms armored warfare really began with the creation of the Truppenamt in 1919 and von Seeckt's leadership in the development of Army doctrine. It was not until 1935 that the Germans decided to create the first Panzer Divisions.[60] Moreover, critical aspects of the combined arms warfare concept had yet to be developed. Contrary to impressions left by historians that German Luftwaffe and Army "Blitzkrieg" operations were well coordinated, the Germans had only begun experimenting with direct communications between airplanes and Panzer Division commanders just prior to the German invasion of France in 1940. In fact, although the experiments held great promise, the invasion's timing forced a delay in incorporation of the experiments insights into accepted German tactics and procedures.[61] Thus German transformation took at least two full decades to mature.

Similarly, the Navy's development of carrier operations began in 1919, when Admiral Sims revamped and re-invigorated Naval War College wargaming where they began to focus on carrier operations in the context of war in the Pacific.[62] From that time until 1942 (and beyond), Naval aviation made critical evolutionary technological advances in range, payload, and speed.[63] But it was not until after the battles of Coral Sea, Midway, and Guadalcanal that multi-carrier task forces were fully implemented.[64]

During those decades, both militaries achieved success in spite of very limited defense expenditures. It was not until 1933 that, at Hitler's direction, the German industrial complex began to ramp up in a meaningful way.[65] The Navy was also forced to postpone several carrier-related projects as a result of funding shortfalls.[66] As an interesting footnote, limited resources

may have actually contributed to both transformations in that it prevented pre-mature "lock-in" of systems that had yet to be fully refined and more technologically advanced.[67]

At Least a Some Civilian Assistance

Both cases benefited from at least a modicum of outside (civilian) influence and assistance. While numerous examples of German civilian assistance can be found, the most striking example is Hitler's critical support of the creation of what would become the Panzer Divisions and associated combined arms maneuver concept. Hitler's approval was based not only on his personal observations during the Field Exercises of 1935, but also on the fact that its fast-paced operational concept complemented his own political objectives.[68]

The U.S. Congress also assisted the Navy at several critical junctures in air carrier development (including significant funding despite low defense budget levels), no doubt influenced by bureaucratically savvy Naval leaders (including Moffett). Congress authorized the creation of the first experimental carrier, the U.S.S. *Langley*, in 1919. It also authorized the creation of the Bureau of Aeronautics, and Navy Air Factory. But in what would later prove to be a critical move, it mandated that aircraft carriers must be commanded by Naval aviators, thus ensuring them a path to senior ranks.[69]

Military Culture Open to Change

Not surprisingly, another common element between the two cases is that, despite significant institutional resistance to change, both militaries maintained an environment or culture genuinely open to new operational concepts. The German *Truppenamt's* system of encouraging the circulation and publication of radical new concepts and ideas in the *Militar-Wochenblatt* for comment by all is but one example.[70] Under this system the Reichswehr published a weekly journal in which both senior and junior officers were encouraged to express

their views, no matter how doctrinally "incorrect" or seemingly farfetched on professional matters (particularly tactics and weaponry).[71] Additionally, officers were encouraged to formally publish original ideas and concepts of operations. Two famous examples include Irwin Rommel's book, *Infantry Attacks*, and Heinz Guderian's *Achtung-Panzer*.

The U.S. Navy's culture was arguably less open to new operational concepts, but the extent and senior-level engagement of the debates within the Navy (e.g., carrier as supporting or supported) is evidence of its openness and intellectual dynamism. Moreover, there was a deep commitment to making critical decisions between competing viewpoints based on the empirical results of experimentation.[72] It is also important to note that Naval aviation initially provided the battleship fleets open-ocean scouting capabilities and target spotting which extended the long-range accuracy for its big guns. Thus Naval aviation began as a key component of the Navy's core competency (sea control via the battleship).

Dramatic Results Despite Limited Forces

At the time of their employment, both the German Army and the U.S. Navy redefined the conduct of warfare with a relatively small number of transformed units. In 1938, the Germans had only three Panzer Divisions when Hitler moved into Czechoslovakia. The Germans achieved dramatic success against a substantial army in Poland with only six Panzer Divisions. Finally, Germany's invasion of France was completed with only 10 Panzer Divisions—out of a total German Army of 117 divisions (barely ten percent of the total Army) and against a foe that slightly outnumbered the Germans.[73]

By 1942, the U.S. Navy had built eight carriers, but only four approximated the (1943) U.S.S. *Essex*-class that would prove so successful throughout the rest of the war. Yet the Navy achieved the dramatic 1942 victories in the Battles of Coral Sea and Midway. Before the war's

end the Navy would field 90 carriers, although many were smaller, escort versions.

Wargaming and Experimentation with Surrogates

Extensive experimentation and wargaming occurred at a time when neither military possessed a single major system prototype. The Versailles Treaty's weapons ban effectively limited German access to tanks until 1929 when the Kazan facility opened in the Soviet Union.[74] At the time Guderian was instructing other officers in tank tactics, it was claimed he had never seen the inside of a tank until the General Staff sent him to Sweden (in 1928) to give him some first-hand experience.[75] Nevertheless, the Germans conducted extensive wargaming with motorized and armored divisions. For example, the winter 1926-27 wargames involved more than 40 General Staff officers engaged in a scenario involving nine red divisions against a blue force of five divisions.[76] Both sides had motorized divisions that included tank companies, and the Germans experimented with different organizational mixes. The fact that both sides also had large air forces but red's air force possessed a disproportionate number of heavy bombers illustrates not only their combined arms perspective, but that the Germans were exploring and trying to learn what might be possible.

The Germans also conducted extensive field exercises with surrogate tanks. Under Guderian's guidance, the Germans first incorporated mock tanks that were bicycles covered by plywood to use during experiments that involved large-scale maneuvers.[77] Later, vehicles were used to better approximate a tank's speed and mobility. Based on accounts of the British 1926 maneuvers (the Germans used the British exercise accounts that were printed in the *Telegraph* as well as the writings of Fuller, Liddell, and others) the Germans began using mock tanks to "…breakthrough repeatedly in order to portray this method of fighting and thus to collect added experience."[78] Later, mock tanks were used under the cover of smoke and field artillery to

experiment with post-breakthrough possibilities deep in the enemy's rear area.

As noted earlier, it was not until 1919 that the U.S. Navy began converting their first ship into an aircraft carrier. In fact, Fleet Problem I involved the use of battleships as surrogates for aircraft carriers.[79] In 1919, Admiral Sims was laying the foundation for extensive data-based rules to govern wargaming at the Naval War College and simultaneously institutionalizing a process of discovery.[80] Before the Bureau of Aeronautics was established in 1921, gaming rules were based on evidence obtained through regular correspondence between aviators and faculty members. Once the Bureau of Aeronautics (BuAer) was established, Moffett and Sims ensured continual exchange of data and concepts.[81] During this period, the wargamers developed several critical insights to focus further refinement. For example, they discovered that carrier airpower is generated in "packets" or "pulses" of power versus the continual stream of volleys produced by battleship guns.[82] They also discovered the enormous tactical advantage of striking first and that hitting opposing carriers should be the first priority. Finally, they established that the critical factor in projecting airpower was to maximize the number of sorties generated (or put another way, minimize the turnaround times).[83] This last insight virtually necessitated the practice of turning aircraft already on the carrier's deck (as opposed to returning aircraft to hangers below for refueling and rearming). This so-called "deck park" practice in turn led to a number of other significant innovations. Armed with these insights and a prototype aircraft carrier (U.S.S. *Langley*), Admiral Reeves and others began to develop new concepts of operations and solutions to obstacles.

Experimentation Grounded in the Real World

Once prototypes became available, experimentation was grounded in detailed analysis and focused on solving specific problems, determining what works and what does not, and exploring new operational concepts.

Von Seeckt and the German General Staff inherited a highly developed system for testing and conducting field exercises from the Prussians. Throughout the late nineteenth-century, the Prussians conducted annual exercises and went to great lengths to simulate actual military conditions in testing doctrine and new weapon systems.[84] The Prussians formalized a system involving free play at the Corps and division levels, involving a group of specifically trained officers who would serve as umpires to determine the results of various actions. The German General Staff improved upon the Prussian rigorous field exercise regime.[85] The 1926 field exercises were the first multi-division maneuvers held since WWI, and involved extensive testing and experimentation with the new maneuver warfare doctrine. The Germans also used these large-unit field exercises to test organizational concepts. Their experimentation process employed an incredibly candid and honest evaluation.[86]

American Naval experimentation consisted of a reinvigorated emphasis on realistic wargaming combined with annual "Fleet Problem" exercises that began in 1923. These Fleet Problems had the beauty of providing the Naval commanders with the opportunity to be creative in solving real-world problems, evolve doctrine and tactics, and make direct observations about equipment limitations. Despite operating in different environments (land/water) the two militaries' experimentation programs shared an impressive number of common characteristics.

Both the Germans (beginning in 1926) and U.S. Navy (beginning in 1923) conducted relatively **large-scale, live-force, annual events utilizing available forces whose purpose was**

both training and experimentation. This system provided for the "hands-on" experience of many different operational and tactical commanders. The result was not only to provide large numbers of soldiers and sailors with realistic combat training, but diversity among participants also led to many tactical-level innovations and operational insights. As previously noted, both militaries transformed during a period when resources were relatively modest. Combining large-scale operational training with experimentation maximized cost effectiveness.

Experiments were not single events; rather they involved concepts that were tested over and over again until the results could reasonably be assured. For example, the Germans tested Panzer Division effectiveness under differing levels of combined arms elements in a series of exercises until they were confident that the optimum mix had been achieved.[87] Similarly, the Navy also tested concepts repeatedly. Each of the Fleet Problems had between six to eight "motives" that were the focus of the event (e.g., attack and defense of a convoy, attacks of attrition by light vessels, submarines and aircraft). Not satisfied with the results of a single run, the same motives would frequently be the focus of several Fleet Problems.[88]

Both the German and U.S. Navy systems provided for **strong institutional and conceptual linkages between wargaming and exercises**. The German wargaming was conducted annually in Berlin, and involved not only officers from a cross-section of specialties (to include navy and air arms) but the diplomatic services as well. Modern air and ground systems were used in these games, including the use of simulated motorized units utilizing new doctrine and organizations. When new doctrine or organizations suggested promise, the next step was to test it during the annual field exercises before incorporating into established doctrine.[89]

The NWC and Fleets had direct institutional linkages whereby the War College conceived of and designed the Fleet Problem scenarios and provided insights derived during gaming. The Fleets then executed the problems and fed the results back to the NWC not only as feedback as to the results, but to be used in the development of subsequent scenarios.[90] Moreover, the NWC used the Fleet Problems to keep its wargaming process tied to the real world. For example, once Reeves had succeeded in increasing U.S.S. *Langley's* launch rates, the rules governing subsequent NWC war games reflected the new rates.[91]

Similarly, the results of both the Field exercises and Fleet Problems were **carefully documented in reports that were widely circulated** throughout the militaries. General von Seeckt established the practice of distributing field exercise reports, often with his personal notes and observations, throughout the German General Staff.[92] Admiral Sims established a symbiotic relationship not only with BuAer in exchange of technical data on aircraft, but with the Fleets as well. There was a continual dialogue between the NWC President and Fleet Commanders that involved distribution of many copies of the Fleet Problem results, as well as associated pre-Fleet Problem staff work throughout the NWC faculty. Moreover, each Fleet Problem was critiqued by the commanders involved, as well as the umpires, and multiple copies of these critiques were also distributed.[93]

Both the German and U.S. Navy experimentation programs had **extensive senior-level involvement** (to include their respective chiefs). The Chief of the General Staff would observe the annual field exercises and frequently comment personally on the results.[94] The Commander-in-Chief of the Fleet actually participated in the Fleet Problems as head umpire, and each of the reports was distributed under his signature.[95]

Both systems utilized **extensive employment of live opposition forces (red teaming) that frequently outnumbered "good guys."** The German's used realistic opposition forces in both their field exercises and wargames. In preparing wargames, opposing forces would study the foreign operational doctrine in order to make decisions that did not simply mirror image the current German thinking.[96] The Germans maintained the Prussian practice of large-scale opposition forces and use of umpires to adjudicate results. German use of opposition forces exceeding German forces on the field may have been a result of their strategic situation. Additionally, they may have wanted to test operational doctrine to determine breaking points.

Virtually all of the U.S. Navy Fleet Problem scenarios led to large-scale, fleet-on-fleet engagements involving various "enemy" forces. Moreover, "red" (British) or "orange" (Japanese) forces frequently outnumbered, or had disproportionate numbers of various combatants (designed to accommodate problem motives) than "blue" forces.[97]

Both cases went to extreme lengths to ensure **field exercises and Fleet Problems were as closely as possible tied to the real world**. German Field Exercises involved large-scale forces maneuvering over long distances and varied terrain. The Germans fielded large force movements that involved various complex combined-arms organizations, testing specific operational and tactical concepts in a highly disciplined and candid manner. Their experimentation and evaluations also emphasized quantitative versus qualitative observations through the adjudication of umpires.[98]

Naval Fleet Problems employed large-scale forces against a variety of amphibious and power-projections scenarios. These Fleet Problems included Marine amphibious and air carrier strike missions (Panama Canal, Pearl Harbor etc.), and were painstakingly designed to approximate the results that would actually occur in wartime.[99] When issues arose as to the

conduct of the Fleet Problems, the overarching criterion to resolve them was to achieve the most realistic results.

To ensure Fleet Problem results were as close to wartime as possible, Navy (and even Joint Army Navy problems) employed a set of high-ranking "umpires."[100] The head umpire was usually the Fleet Commander-in-Chief, who employed a team to evaluate combat results against a strict set of guidelines.[101] Umpires "instructions" (published as a Joint Regulation for Army-Navy problems) were issued annually utilizing the latest empirical experimental results for specific weapon system effectiveness.[102] Moreover, draft umpire instructions were widely coordinated to ensure accuracy.

Similar to their German counterparts, each of the Fleet Problems tested a specific set of operational and tactical concepts (called "motives"). These motives normally numbered six to eight objectives that defined what the Navy hoped to gain, and shaped the after-action reports and post-problem debriefings. The Naval War College, Navy Headquarters, and the Fleet staff's would nominate motives for the problems, and the motives would guide scenario development.[103]

Actions of both German and U.S. commanders on both sides of the exercises/problems were not scripted, and uncertainties as to opponents' forces, intentions, and communications were kept secret from their respective opponents.[104]

Both programs tested operational concepts and tactical ideas **that failed**. It is important to note that experimentation regimes that only succeed are highly suspect. The French program is a perfect example. Rather than test new concepts, the French sought to "prove" the efficacy of their own doctrine and approach to the conduct of war.[105] In fact, often a great deal more can be learned from failure. The German's learned a great deal from the "failed" British maneuvers of 1934, which reaffirmed the efficacy of their combined-arms approach.[106]

Two examples serve to illustrate that both militaries were free to fail and the fact that they did is testament to the rigor of their experimental processes. As early as the von Seeckt days, the Germans (and most other militaries) theorized that the cavalry would benefit from employing motorized units along with horses. It was generally believed that the horses could be effectively employed in more difficult terrain, while motorized units could move more quickly in flatter less complex terrain. This remained German doctrine until the concept was tested in the 1932 field exercises. Contrary to their doctrine, the German testing of the utility of combining horse and motorized cavalry revealed that no synergy was achieved between the two. In fact, horse-based cavalry was discovered to be simply inferior and unable to keep pace with other mechanized units.[107]

Similarly, the U.S. Navy's employment of independent carrier operations revealed serious shortcomings. The Naval War College theorized that carriers could project power by attacking land-based units independently. Under the rigors of Fleet Problem testing, it became clear that carriers were simply too vulnerable to attack and required other parts of the fleet for protection.[108] This realization led to a great debate as to whether the carrier was a supporting capability (for the battleship big guns) or whether it was supported as the primary mode of power projection.

Empirical and observed **experimental results proved critical in overcoming institutional resistance** in both cases. As previously discussed, the Germans did not commit to Panzer Division creation until after the 1935 field exercises confirmed the potential of armored mechanized capabilities to wreak havoc in an enemy's rear area once the breakthrough occurred. After the Polish campaign, and even after the invasion of France, numerous Panzer Division commanding generals attributed their astounding success to factors other than the combined

armored maneuver phenomena.[109]

Even in the face of a cataclysmic turning point such as Pearl Harbor, institutional resistance to adopt aircraft carriers as the centerpiece of the fleet persisted (the battleship admirals). In the spring of 1942, the Navy's General Board (responsible for major acquisition decisions) proposed a plan to build only nine additional carriers through 1944, while maintaining the production of five battleships. It was not until May of that year that then Chief of Naval Operations Admiral Ernest J. King independently modified the Board's plan and deferred battleship construction indefinitely.[110]

Important Differences

Despite the similarities, dramatic differences also characterized the transformations of the two militaries. The fact that important differences existed highlights the complexity of successful transformation and the potential pitfalls in developing generalizations from historical case studies. Nevertheless, even some elements of the major departures between these two cases represent potential insights for the current U.S. military.

Consistent with its Prussian heritage, the German *Reichswehr* conducted a rigorous, systematic, and **comprehensive analysis of the last war**. Under von Seeckt's guidance, the Germans organized into 57 committees to examine each aspect of the conduct of WWI. Each committee was to answer questions such as: what new conditions arose during the war that were not anticipated, how effective did pre-war concepts deal with new conditions, and what new problems in the war have yet to be resolved?[111] The WWI veteran soldiers often wrote the results themselves, and the entire effort numbered about 400 officers in all.[112] Each of the committees was brutally candid about every aspect of the conduct of WWI, and the results of the reports were eventually incorporated into the German capstone doctrine document *Leadership and*

Battle with Combined Arms. Unfortunately, there was no comparable comprehensive effort conducted by the victorious U.S. forces.

The Treaty of Versailles also **precluded the Germans from maintaining a large military and key weapon systems**. This provided the opportunity to build their military from scratch, without the doctrinal, institutional, and budgetary onus of large numbers of legacy systems. Although the U.S. Navy was constrained by the 1922 Washington Naval Treaty's limitations on the tonnage of capital ships, the Navy maintained a number of legacy ships. Moreover, the Treaty may have actually helped the Navy's ultimate decision to pursue larger carriers over smaller ones (a critical factor in U.S. Navy success).[113]

The Germans were also afforded the opportunity to learn a number of critical lessons as a result of **experiments conducted in actual combat during the Spanish Civil War**. Although Hitler had political reasons for Germany's involvement, the war did provide the military an outstanding low-threat environment to conduct experiments under combat conditions. The Germans applied the same systematic and brutally candid analytical regime to its combat experience in Spain. The results were fed into, and directly contributed to, the German combined arms concept of operations. For example, the Luftwaffe developed the finger four formation (later adopted by all major militaries), made significant progress in refining close air support doctrine, and recognized significant limitations in strategic bombing theory.[114] Nevertheless some "wrong" lessons were learned—especially by the Luftwaffe.[115]

The U.S. Navy had no such opportunity to experiment in a small-scale conflict, but as highlighted earlier, it had an elaborate system for ensuring the results of Fleet Problems were as close as possible to those of combat and were grounded in the real world.

A number of U.S. Navy decisions that would prove critical to their success were, at least

in part, motivated by **inter-service rivalry** and a sense of competition with the British Navy. Of particular concern was Billy Mitchell's call for a single unified air service. This caused a sense of urgency for the Navy to make some crucial decisions. For example, the creation of the Naval Bureau of Aeronautics and the Naval Aircraft Factory were both motivated, at least in part, by fear of a single air service.[116] No such rivalry spurred the German *Wehrmacht* to pursue creation of the Panzer Divisions in 1935. In fact, German inter-service cooperation was notably higher than that of other nations at the time.[117]

Framework for Analysis and Importance of Experimentation

Contrasting and comparing these two cases highlights their striking similarities and provides significant insights into some of the key elements that led to these successful transformations. The resulting framework is useful in the examination of current U.S. military efforts to transform:

Visions/Visionary leaders (persistent tenure)

Pressing national security concern

Detailed, systematic study and analysis of other nation's experiments and military thinking

Decades to develop (recognition that it will take time)

At least a modicum of outside (civilian) influence and assistance

An environment or culture genuinely open to new operational concepts

Extensive experimentation and wargaming without a single major system prototype

Extremely realistic experimentation grounded in detailed analysis and focused on solving specific problems and exploring operational concepts

Large-scale, live-force, annual events utilizing available forces whose purpose was both

training and experimentation

Experiments were not single events

Strong institutional and conceptual linkages between wargaming and exercises

Carefully documented in reports that were widely circulated

Extensive senior-level involvement

Extensive employment of live opposition forces (red teaming) that frequently outnumbered "good guys"

Field exercises and Fleet Problems were as closely as possible tied to the real world

Experiments that failed

If only a single common element were to be selected as most important in these two cases—clearly it would be the two militaries' approach to experimentation. There are numerous and significant similarities between the two experimentation regimes, including end-to-end linkages to doctrine, integration of wargaming, the extent of coordination and documentation of results, unscripted live large-scale force on force engagements, and most importantly, their commitment to experimentation grounded in the real world. In fact the lack of a comprehensive, fully developed experimentation program is the single element that is found either totally lacking or inadequately developed by those militaries that failed in pursuit of the challenge posed by the interwar years.

As noted earlier, the French system never really challenged its own doctrine and was more prone toward demonstrations of capability than genuine experimentation.[118] The French military culture became so intolerant of alternative ideas that dissension from established French doctrine came to be interpreted as a breakdown in military discipline.[119] As a result, the French

focused on most effectively incorporating tanks, trucks, and automobiles into *existing* doctrine and organizations, rather than realizing what possibilities the new technologies could create.

Despite the early British lead in the development of armored maneuver warfare through advanced warfighting experiments, they failed to adequately develop a systematic doctrinal or conceptual framework to test new theories and also failed to provide institutional linkages to the operational Army.[120] Moreover, armored maneuver warfare did not fit into British strategic perspectives as the government prohibited the British army to plan for war on the European continent.[121]

Although hampered by a myriad of factors, British failure to achieve aircraft carrier supremacy despite their dramatic lead can clearly be tied to a faulty experimentation regime that failed to systematically and analytically test a vision of offensive concepts of operations for carriers. Thus the British never fully comprehended the critical insights ("packets" or "pulses" of airpower, deck parks, etc.) conceived at the Naval War College. Therefore they never fully exploited subsequent American technical innovations (open hangers for exhaust ventilation, arresting barriers etc.) and, due to reliance on naval multi-purpose aircraft, also failed to fully develop dive bombing techniques which proved so critical to air carrier effectiveness.[122]

The U.S. and British over estimation of the potential effects of strategic bombardment can also be traced to a failure to introduce sufficient realism into their experimentation. British bombing ranges clearly pointed out the locations of targets thus obviating the requirement to find them in the first place.[123] In fact, a post-war study determined that only 17 percent of Bomber Command's bombs fell to within *three miles* of their intended targets.[124]

Despite creation of the Experimental Mechanized Force in 1927, the U.S. Army's experimentation program contributed to its failure to comprehend the potential of combined arms

mechanized warfare. The Army's program was characterized by a lack of resources, failure to challenge doctrine (tanks viewed as arm of the infantry), numerous interruptions, and bureaucratic infighting.[125]

Notes

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[2].-Ibid., p. 18-19.

[3].-Lt. Col. Christian C. Daehnick, "Through a Glass, Darkly: Innovation and Transformation in the Twenty-First Century Air Force" (paper, April 2001), 9.

[4].-Andrew F. Krepinevich, *The Bush Administration's Call for Defense Transformation: A Congressional Guide,* (Washington, D.C.: Center for Strategic and Budgetary Assessments, June 2001), 2.

[5].-Senate, *Military Transformation: Hearings before Senate Armed Services Committee,* 107th Cong., 2d sess., 2002, 5.

[6].-Barry D. Watts, memorandum for record, subject: What Is the "Revolution in Military Affairs"?, 6 April 1995 (first printed on 2 February 2000).

[7].-A. W. Marshall, director, office of net assessment, memorandum for record, subject: Some Thoughts on Military Revolutions, 27 July 1973.

[8].-Williamson Murray, "Thinking About Revolutions in Military Affairs ," *Joint Forces Quarterly,* Summer 1997, 73.

[9].-Goldman, 1-7, for a more complete discussion of the diffusion phenomena.

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[10].-United States Commission on National Security, *New World Coming: American Security in the 21st Century,* Phase I Report on the Emerging Global Security Environment for the First Quarter of the 21st Century (Washington, D.C., 15 September 1999), 3.

[11].-Charles Dunlap, "Joint Vision 2010: A Red Team Assessment," *Joint Forces Quarterly,* Autumn/Winter 1997-98, 49.

[12].-Dan Coats, "Joint Experimentation—Unlocking the Promise of the Future," *Joint Forces Quarterly,* Autumn/Winter 1997-98, 14.

[13].-Goldman, 7-10.

[14].-Bill Keller, "The Fighting Next Time," *NY Times,* Sunday, 10 March 2002, sec. 6

[15].-United States Commission on National Security, 8.

[16].-V.K. Nair, *War in the Gulf* (New Delhi, Lancer International, 1991).

[17].-Department of Defense, *Quadrennial Defense Review Report,* (Washington, D.C.: Government Printing Office, September 2001), 22. While the 2001 Quadrennial Defense Review explicitly rejected the two major theater war strategic construct, it did not change the force structure, which is rooted in the Bottom Up Review building blocks.

[18].-Frank Finelli, "Transforming Aerospace Power," *Airpower Journal* XIII, no. 2 (Summer 1999): 4-12.

[19].-President-elect George W. Bush, "A Period of Consequences," address to The Citadel, Charleston, S.C., 24 September 1999.

[20].-President George W. Bush, commencement address to the U.S. Naval Academy, Annapolis, M.D., 25 May 2001. "I'm committed to building a future force that is defined less by

size and more by mobility and swiftness, one that is easier to deploy and sustain, one that relies more heavily on stealth, precision weaponry and information technologies."

[21].-Department of Defense, *Report of the Quadrennial Defense Review,* (Washington, D.C.: Government Printing Office, May 1997), sec. 7.

-Department of Defense, *Annual Report to the President and the Congress,* (Washington, DC.: Government Printing Office, April 1997-2001), part 3.

-Department of Defense, *QDR,* September 2001.

[22].-Department of Defense, *QDR,* September 2001, 16.

[23].-Secretary of Defense Donald H. Rumsfeld, *"21st Century Transformation"* address, National Defense University, Washington, D.C., 31 January 2002.

[24].-Senate, *Statement of The Honorable Donald H. Rumsfeld prepared for the Confirmation Hearing before the U.S. Senate Subcommittee on Armed Services,* 107th Cong., 1st sess., 2001.

[25].-Department of Defense, *QDR,* September 2001, 40-46.

[26].-Senate, *Testimony of Secretary of Defense Paul Wolfowitz prepared for the Senate Armed Services Committee Transformation,* 107th Cong., 2d sess., 2002, 7-9.

[27].-Keller, 16. Andrew Krepinevich is quoted as calling these items "poster children for transformation."

[28]-Senate, *Testimony Delivered on Military Transformation,* 107th Cong., 2d sess., 2002, 16-19.

[29].-This is somewhat an extension of fighting the last was as Iraq mirrored Soviet doctrine and military style that became the sizing and shaping model for the two Major Theater War

capabilities that governed U.S. forces over the past decade and formed the basis of Carter-era weapons and platforms that only now being funded by the George W. Bush administration.

[30].-Williamson Murray and Barry Watts, "Military Innovation in Peacetime" (paper written for the Director of Net Assessment, Mr. A.W. Marshall, as part of a contractual research effort by the Mershon Center, Ohio State University, on military innovation during 1918-1939, June 1995), 62-63.

[31].-Andy Marshall, long-time Director of the Office of Net Assessment observed many of the similarities, and sponsored many historical assessments of past innovation, transformations, and so-called Revolutions in Military Affairs.

[32].-Whether or not the term was ever used by the Germans during the war is the subject of some controversy, but it appears it first appeared in a *Time* magazine article to describe the rapid offensive phenomena of German combined arms armored maneuver warfare during the Polish campaign. See the editor's note *Actung Panzer*, p 7-18.

[33].-Murray and Watts,1-63. The most similar effort was written by Murray and Watts in their analysis of German combined armored warfare, strategic bombardment and carrier aviation.

[34].-Many authors and historians have developed similar key elements that are necessary for innovation, transformation, or revolutions in military affairs. For example see Williamson Murray and Allan R. Millett, editors, *Military Innovation in the Interwar Period,* (United Kingdom: Cambridge University Press, 1996), 310-325. See also Richard O. Hundley, *Past Revolutions, Future Transformations What Can the History of Revolutions in Military Affairs Tell Us About Transforming the U.S. Military?,* RAND-MR-1029-DARPA (Santa Monica,

C.A.: RAND, 1999) 59-79. See also Andrew Krepinevich, *Transforming to Victory: The U.S. Navy, Carrier Aviation, and Preparing for War in the Pacific,* (Washington, D.C.: The Olin Institute, 2000) 1.

[35].-Peter Rosen, *Winning the Next War: Innovation and the Modern Military* (Ithaca, N.Y.: Cornell University Press, 1991), 251.

[36].-Murray and Watts, 20-40.

[37].-There is considerable debate among historians as to the importance of each of these visionaries. For example see Murray and Watts, 8-9 on role of Guderian. See also James S. Corum, *The Roots of Blitzkrieg: Hans Von Seeckt and German Military Reform* (Lawrence, K.S.: University Press of Kansas, 1992) 136-140 on misconceptions.

[38].-Harold R. Winton and David R. Mets, editors, *The Challenge of Change: Military Institutions and New Realities, 1918-1941.* (Lincoln, N.E.: University of Nebraska Press, 2000), 39.

[39].-Holger Herwig, "The Prussian Model and Military Planning Today," *Joint Forces Quarterly,* Spring 1998, 67-69.

[40] Its emphasis on the offensive can clearly be seen "The attack alone brings the decision…especially effective is the envelopment of one or more flanks and to attack the enemy's rear…." Corum, *The Roots of Blitzkrieg*, 40.

[41]-Major General Heinz Guderian, "Armored Forces: Cooperation Between Armored forces and Other Arms," *Infantry Journal,* November-December 1937, 522-528.

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[43].-Addington, 36.

[44].-Murray and Millett, 41-42.

[45].-Ibid., 192-197.

[46].-Ibid., 392.

[47].-Andrew Krepinevich, *Transforming to Victory: The U.S. Navy, Carrier Aviation, and Preparing for War in the Pacific,* (Washington, D.C.: The Olin Institute, 2000), n.p. See footnote number 4.

[48].-Murray and Millett, 394.

[49].-For a more complete discussion of Admiral Moffett's contribution see Jan M. Van Tol, "Military Innovation and Carrier Aviation—An Analysis," *Joint Forces Quarterly,* Autumn/Winter 1997-98, 103-104.

[50].-Krepinevich, *Transforming to Victory,* 12-16.

[51].-Jan M. Van Tol, "Military Innovation and Carrier Aviation—The Relevant History," *Joint Forces Quarterly,* Summer 1997, 87.

[52].-James S. Corum, *The Roots of Blitzkrieg: Hans von Seeckt and German Military Reform* (Lawrence, KS: University of Kansas Press, 1992), p. 197-198.

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[55].-Winton and Mets, 40-41.

[56].-Azar Gat, *British Armour Theory and the Rise of the Panzer Arm* (New York, N.Y,: St. Martin's Press , 2000), 63.

[57].-Murray, *Experimentation in The Period Between the Two World Wars,* 7-8.

[58].-Van Tol, " . . . The Relevant History," 80-81.

[59].-Murray and Millett, 203-226.

[60].-Addington, 41-42.

[61].-Murray, *Experimentation in The Period Between the Two World Wars,* 12.

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[63].-Van Tol, " . . . The Relevant History," 85-87.

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[68].-Winton and Mets, 57-58.

[69].-Murray and Millett, 209-211.

[70].-Gat, 55.

[71].-Corum, *The Roots of Blitzkrieg,* 87.

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[72].-Van Tol, " . . . An Analysis," 109.

[73].-Corum, *The Roots of Blitzkrieg,* 202-203.

[74].-Corum, *The Roots of Blitzkrieg*, 190-192.

[75].-Gat, 60.

[76].-Corum, *The Roots of Blitzkrieg*, 187-188.

[77].-Ibid., 132-134.

[78].-Murray and Millett, 40.

[79].-Krepinevich, *Transforming to Victory,* 7.

[80].-Murray and Watts, 47-48.

[81].-Van Tol, " . . . An Analysis," 102.

[82].-Van Tol, " . . . A Relevant History, " 80.

[83].-Van Tol, " . . . An Analysis," 102.

[84].-Herwig, 69-70.

[85].-Winton and Mets, 48.

[86].-Murray, *Experimentation in the Period Between the Two World Wars*, 10 see footnote 19.

[87].-Ibid., 51.

[88]-Reports of the Commander-in-Chief, United States Fleet, United States Fleet Problems XIII-XV, 1932-1936, Naval War College Historical Collection, Record Group 8, Boxes 62-64.

[89].-Winton and Mets, 48-49.

Notes

[90].-Van Tol, " . . . An Analysis," 80. See also Rosen, 68-71. See also Murray and Millett 317.

[91].-Murray and Watts, 55.

[92].-Corum, *The Roots of Blitzkrieg*, 132-136.

[93].-Naval War College Historical Collection, Record Group 8, Boxes 56-62.

[94].-Williamson Murray, "Comparative Approaches to Interwar Innovation," *Joint Forces Quarterly,* Summer 2000, 85.

[95].-U.S. Fleet *Umpire Instructions*, 27 October 1931 Naval War College Historical Collection, Record Group 8, Box 62.

[96].-Winton and Mets, p. 48.

[97].-Krepinevich, *Transforming to Victory,* 8-12.

[98].-Winton and Mets, 48-51.

[99].-U.S. Fleet *Umpire Instructions*, 27 October 1931 Naval War College Historical Collection, Record Group 8, Box 62, 3-5.

[100].-Ibid., 9-10.

[101].-Ibid., 11.

[102].-Commander Aircraft, U.S. Fleet to Commander Battle Force, letter, subject: U.S. Fleet Umpire Instructions, 1932, 30 September 1932. Naval War College Historical Collection, Record Group 8, Box 62. Excellent example of proposed changes to Umpire Instructions to reflect the improved effectiveness of dive-bombing on battleships.

[103].-Van Tol, " . . . An Analysis," 102.

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[104].-Commander-in-Chief, U.S. Fleet to Fleet, letter, subject: U.S. Fleet Umpire Instructions, 27 October 1931. Naval War College Historical Collection, Record Group 8, Box 62.

[105].-Williamson Murray, "Thinking About Revolutions in Military Affairs," *Naval War College Review,* Spring 2001 72-76.

[106].-Murray, *Experimentation in the Period Between the Two World Wars*, 7.

[107].-Winton and Mets, 49-50.

[108].-Krepinevich, *Transforming to Victory,* 8-11.

[109].-Murray and Watts, 19.

[110].-Krepinevich, *Transforming to Victory*, 14. Part of the decision to abandon building battleships involved production delays caused by limited availability of battleship armor plating.

[111].-Murray and Watts, 13.

[112].-Winton and Mets, 40-41.

[113].-Murray and Watts, 51-52.

[114].-Williamson Murray, *German Military Effectiveness,* (Baltimore, M.D.: The Nautical & Aviation Publishing Company of America, 1992), 102-111. For an excellent discussion of lessons learned and German close air support doctrine.

[115].-James S. Corum, *The Luftwaffe: Creating The Operational Air War 1918-1940,* (Lawrence, K.S.: University Press of Kansas, 1997) 205-212.

[116].-Krepinevich, *Transforming to Victory*, 3-4.

[117].-Murray *German Military Effectiveness,* 106.

[118].-Winton and Mets, 12-20. See also Murray and Millett, 226.

Notes

[119].-Ibid. p. 11.

[120].-Murray and Watts, 19. See also Winton and Mets, 48.

[121].-Ibid., 20.

[122].-Van Tol, " . . . A Relevant History," 83-85.

[123].-Murray and Watts, 26.

[124].-Ibid., 26. See footnote 104.

[125].-Winton and Mets, 168-190.

Chapter 2

Prospects for Transformation of the U.S. Military

Horse cavalry is characterized by a high degree of battlefield mobility. Its special value is derived from the rapidity and ease with which its fire power can be moved from one position or locality to another.

—Field Manual 100-5

15 June 1944

Applying the Historical Framework to the Present

Myriad of Diverse Organizations, Cultures, and Activities

According to its official reports and testimony, the Department is (and has been) fully committed to transform itself and currently has a complex and diverse set of organizations and ongoing activities committed to this effort. While it is almost impossible to define all the organizations and include all the activities that are purportedly linked to transformational change, the following list is informative:

Joint Efforts:

OSD: Advanced Concept Technology Demonstrations (ACTDs), Advanced Technology Development (ATDs), Defense Science Board, Advanced Research Projects Agency (ARPA), Joint Theater Air and Missile Defense Office (JTAMDO), Ballistic Missile Defense

Organization (BMDO), transformational oversight (USD(P)), wargaming primarily through Office of Net Assessment, and newly created Director for Transformation (VADM Cebrowski)

CJCS: J-6 (Information Superiority Experiments), J-7 (Joint Vision and Joint Vision Implementation Plan), Joint Advanced Warfighting Program (JAWP), various implementation efforts

JFCOM (then ACOM) chartered as DOD executive agent for joint experimentation, J-9 organization, JWFC, Joint Forces Lab, Joint Battle Center, various experiments (Millennium Challenge, Unified Vision, Olympic vision etc.), Rapid Decisive Operations (RDO) and related wargames and seminars

Service Efforts:

Army: Army After Next/Transformation wargames, Advanced Warfighting Experiments, battlelabs, Interim Brigade Combat Teams

Navy: Naval Warfare Development Center, Fleet Battle Experiments, Sea-Based Battle Lab, Global and Strategic Concepts Wargames

Marine Corps: Warrior Experimentation Series, Marine Corps Warfighting Lab, Special Purpose Marine Air Ground Task Force, and ChemBio Incident Response Force

Air Force: Expeditionary Aerospace Force Concept, Future Total Force, battlelabs, Expeditionary Force Experiments, and Global Engagement and Future Capabilities wargames

These diverse and numerous organizations are engaged in a veritable tornado of transformational activity, but where is it all headed?

Visions/Visionary leaders (with persistent tenure)

Future visions of warfare must, out of necessity, be somewhat vague and imprecise. History shows that the intellectual heavy lifting sufficient to develop a detailed new theory of warfare requires continual reappraisal and revision.[1] As illustrated by the historic cases, the key to a vision capable of nurturing a successful transformation is that it must define a fundamental shift in the conduct of warfare and address a driving national security concern and associated threats. Both the German and U.S. Navy visionaries were bounded by real security issues and identified fundamental shifts in warfare from the past.

Joint Vision 2010 (JV2010) originally resulted from Congressional pressure on the Chairman of the Joint Chiefs of Staff (CJCS) to define a vision to guide the Department. The basis of JV2010 was that the traditional Army battlefield functions of maneuver, firepower, logistics, and protection would be transformed through technological innovation and information superiority into Dominant Maneuver, Precision Engagement, Focused Logistics, and Full Dimensional Protection. The fusion of these concepts, fully realized, would theoretically result in the attainment of Full Spectrum Dominance.[2]

The Problem with JV2010, and its successor JV2020, is that they lack sufficient specificity to guide the incorporation of technological innovation and information superiority into the battlefield functions. Furthermore, they ultimately fail to address specifically how the fundamental conduct of warfare will change. Finally, it is not clear what specific national security challenge is being addressed. For example, while JV2020 highlights risks associated with adversary pursuit of asymmetric capabilities and strategies—it fails to define how enemies could combine these capabilities and what associated U.S. concepts of operations could be employed to counter them. Joint Vision 2010 (and its successor) has also been widely criticized

as being all things to all people.[3] As the Joint Vision documents undergo extensive staffing within the joint community, the process has a tendency to dilute ideas and concepts that threaten vested institutional interests.

Given the nature of the JV2010 document, it is not surprising that the subsequent 1998 effort by the Chairman's staff to implement the vision proved inconclusive.[4] Neither of the Joint Vision documents has thus far proved to be sufficiently defined to inform the transformation process or drive the direction of meaningful experiments.

The Service visions have generally embraced the JV2010/2020 constructs, but again, tend to lack specificity. Rather they tend to be more like public relations documents generally defining their Service core competencies and reflecting their general cultures. They do not attempt to define substantive shifts in the conduct of warfare, nor do they define specific threats to national security or U.S. military dominance that could focus their transformational efforts.[5] Nevertheless some Services, joint organizations, and senior visionary leaders have introduced alternative operational concepts that, while beyond the scope of this paper to evaluate or even adequately document, appear to have the potential of changing or at least addressing shifts in the fundamental conduct of warfare.

The Navy's capstone concept of Network Centric Operations, and its enabling "pillars" of gaining the knowledge advantage, assured access, effects-based operations, and forces forward shows promise. This capstone concept at least begins to address a pressing national security problem (anti-access/area denial) and may very well outline a significant shift in the conduct of warfare (Network Centric Operations). The Navy's vision aims to network the effects of geographically dispersed warfighters to achieve Combined Engagement Capability and associated Ring of Fire concepts. The vision appears to be based, at least in part, on Admiral

Cebrowski's ('97) Network Centric Warfare vision. Network Centric Warfare employs an interconnected network composed of three grids: Information Grid, Sensor Grid, and an Engagement Grid to enable rapid tactical and operational decision making and fight in ways that were not before possible.[6]

Admiral Owens' ('96) (then Vice Chairman of the Joint Chiefs of Staff) concept of a Systems-of-Systems, is somewhat similar and is based on achieving a synergy between sensors, advanced Command, Control, Communications, and Computers, and advanced intelligence processing, that are linked to precision shooters.[7] A systems-of-systems approach is not really new, for example German combined arms armored maneuver warfare could be thought of as such. Nevertheless, the complexity and integration that Admiral Owens proposes is of an order of magnitude greater than ever achieved before—and with as yet uncertain consequences for the conduct of future warfare.

The Air Force's Global Strike Task Force is a joint concept specifically designed to overcome an enemy's advanced integrated anti-access capabilities. It employs advanced manned, unmanned, and space-based C4ISR capabilities including predictive-analysis tools. It is essentially an operational concept that combines stealth technologies (F-22 and B-2) with advanced munitions, joint standoff weapons, and specialized ground operations to create a synergistic vanguard force to strike air defenses, ballistic-missile sites, and CBRNE storage sites and clear the way for more vulnerable and shorter-range follow-on forces.[8] The concept is an ambitious one, but also one that promises to address a clear strategic challenge and appears to be sufficiently defined to guide subsequent transformational activities.

JFCOM has introduced and based many of its experiments on the concept of Rapid Decisive Operations (RDO). The RDO, as an "evolving" concept, attempts to achieve a rapid

victory by attacking coherence of enemy's fighting ability through the synchronous application of all means of national power via effects-based operations. It maximizes U.S. asymmetric advantages (knowledge through operational net assessment, command and control through improved joint processes, and operations through JV2010 infused battlefield functions) through joint networked operations.[9] Criticized by some as neither revolutionary nor even experimental, RDO is viewed by its critics as simply "getting there the fastest with the mostest."[10] Is "operational net assessment" simply "know your enemy"? Are "effects-based operations" really new?

While some of these visions show some promise, an area that is widely recognized as problematic is the tenure of visionary leaders in leading U.S. military organizations. Recall that von Seeckt held his position for seven years. Guderian held various posts over the 17 years leading up to his command of one of the Panzer divisions, yet all were related to tank and mechanized warfare, and he held two key positions on the general staff over an 8 year period. Beck was Chief of the German General Staff (under different names) from 1933 to 1938. Moreover, Moffett was assigned for an unprecedented third term and served for 12 years as Chief of the Navy's Bureau of Aeronautics at a critical time in air carrier development, and Reeves served in numerous carrier-related posts throughout much of the Navy's transformational era.

There are arguably dangers in persistent tenure, particularly if the senior visionary leader ignores competent evidence contrary to the path being pursued. Yet, the current Commander in Chief (CINC) of JFCOM will typically serve only two or three years. Similarly, Service Chiefs, and CJCS generally have limited tenure of a maximum of four years, and the majority of the uniformed senior Pentagon leaders serve much shorter terms—hardly enough to husband a future

vision of warfare into its next phase in the transformation process. While there is a possibility of greater longevity on the civilian side, the Presidential 4-year cycle may intervene. The appointment of retiring military visionaries to civilian posts, such as the appointment of Admiral Cebrowski offers a potential, but limited, solution.

In summary, some Service and individual senior visionaries may offer the framework to inspire and guide a genuine U.S. transformation, particularly those that most clearly address future strategic and operational challenges, but the process will be hampered by a lack of tenure by key high-ranking participants.[11]

Pressing National Security Concern (Sense of Urgency)

Many of the proponents of an U.S. military transformation have argued that the absence of a "near-peer" competitor following the demise of the Soviet Union has created a strategic pause and, therefore, created the opportunity to divert resources from maintaining current capabilities to transform. Analysts tend to agree that a "near peer" may not manifest until around 2010, and probably not until 2015 or so. Nevertheless, assuming (based on the historical cases) that it would take two decades to effect such a transformation of U.S. military capabilities—we may have already squandered as many as 12-13 years. While there is no way of knowing when, where, or with whom, the next major conflict will occur, the Department must resolve to achieve a more rational balance between resourcing today's readiness and preparing for an uncertain future.[12]

Many observers (including high-ranking OSD officials, military analysts, and past Service Chiefs) have made a case that the so-called area denial and anti-access asymmetries would create huge problems for the United States today in the execution of current war plans.[13] Such threats will surely represent even greater problems in the future, and may even succeed in

creating strategic paralysis through unacceptable losses or threats to the homeland absent a genuine military transformation. The events of September 11th should provide a wake-up call for the possibility of asymmetric warfare against the United States.

During large-scale warfare, what are the chances that future adversaries or enemy coalitions will ignore U.S. power-projection vulnerabilities such as long lines of communications, narrow straits, fixed forward bases, enemy littorals, and ports of embarkation and debarkation? While there is little doubt that the U.S. could face significant current challenges in projecting power in a major war, it is difficult to generate a sense of urgency in the face of near flawless military execution of conflicts since, and including, Desert Storm.[14] In fact the Defense Science Board, in its 1999 report, specifically highlights the lack of perceived urgency on the part of Services and other members within the Department.[15] Similarly, the National Defense Panel in its review during the 1997 QDR, called for the immediate implementation of sweeping changes designed to effect a U.S. military transformation that the Department is only now beginning to implement.[16] Finally, the U.S. Commission on National Security/21st Century concluded that area denial and asymmetric threats represent a real military challenge.[17]

The U.S. military does face significant national security problems, whether in the emergence of a "near-peer," expanded area denial asymmetries, or in other forms of warfare (space control, information warfare, and terrorism) sufficient to motivate and focus a genuine transformation. Nevertheless, the Department has yet to demonstrate a real sense of urgency either in budget decisions involving experimentation or policy changes that set the stage for dramatic change.[18]

Detailed, Systematic Study and Analysis of Other Militaries (or Actors) Experiments and Operational Thinking

The study of other nations' and sub-nations' transformational and experimentation by the Department is arguably hampered by many factors, including U.S. superpower status and conventional dominance, uncertainty as to future enemies, and a lack of experimental activity in other militaries especially at the operational level. Not withstanding certain classified Defense Intelligence Agency and Service intelligence "transformation watch" activities and various orders of battle intelligence, there appears to be very little study of the innovative activities of others. This is evidenced by the limited number of articles published about alternative concept of operations that are being explored by other militaries in any of the American military journals.[19]

Certainly, there are countries (India, China, Iran, Russia, France etc.) and stateless actors that are exploring new concepts of warfare relevant to U.S. transformation; yet, if the Department is translating the burgeoning open literature and concept documents, very little is being done in an unclassified manner. Nor is this information available to the preponderance of American officers whose professional duty requires an awareness of the focus and thinking of potential adversaries. As a result, a potentially rich source of stimulus for thought, alternative ideas, and debate is lost for the American military today. If one were to compare the American effort today to that of the German General Staff during the interwar period—there simply would be no comparison.

Decades To Develop

The flip side of a sense of urgency is recognition that a genuine transformation takes time—at least two decades in the historical cases, and perhaps even longer today (in spite of

ever-increasing rapidity of technological advances) particularly in the face of an uni-polar, persistent peace. This fact is important to those who would attempt to "schedule" the transformation. The perils associated with scheduling the transformation include the need to resist the urge to make unalterable decisions now, based on insufficient information. It is entirely possible for the U.S. to embark on the "wrong" transformation.[20] Furthermore, due to extensive funding, it is possible that the U.S. could prematurely "lock-in" weapons systems and associated concepts of operations before they are sufficiently mature.[21]

Both historical cases illustrated that a remarkable level of success is achieved with the transformation of a relatively small percentage of the overall force structure. Both historical cases also illustrate that even in the face of proven battlefield or field exercise success there will continue to be institutional resistance and general failure to recognize the altered framework of warfare.

While it is important to act decisively to achieve transformational change during this interwar period, there is no substitute for due deliberation and evidentiary-based decisions. Based on the current national security environment, the U.S. military would appear to have some time —but it is passing quickly. The bottom line is that the jury is out on whether U.S. institutions have the wisdom to avoid critical mistakes, or blindly pursue the wrong transformation, or prematurely lock into systems that are not sufficiently mature.

At Least A Modicum Of Outside (Civilian) Influence and Assistance

Based on the amount of rhetoric, testimony, and recent events, one would surely assume that the U.S. military has ample support not only from the President and SecDef, but from Congress as well. Congress is uniquely positioned to influence the upcoming transformation due to the fact it is able to intervene decisively in military affairs even in the face of substantial

opposition, well beyond its budgetary appropriations influence.

The problem in judging current U.S. civilian support is several fold. First, progress has been relatively slow, even in historical transformational terms.[22] As a result, the civilian leadership has had scant opportunity to intervene effectively. Although JV2010 resulted from Congressional pressure, it is not clear how much it really has, or will, accomplish in terms of advancing transformation.

The appointment of Atlantic Command (now JFCOM) as Joint Experimenter, first called for by Senator Dan Coats,[23] may prove to be critical, but its large J-9 organization has yet to conduct its first major live experiment (scheduled for July-August 2002). Appointment of a CINC for long-term experimentation may not be the wisest choice: CINCs tend to be focused on the near-term, don't possess the expertise or the staff for acquisition functions, rely on the Services for their Programmed Operation Memoranda budgeting and funding, and could be hampered by joint processes. Joint bureaucracies tend to innovate via committee leading often to slow and lowest-common denominator results, whereas Service-obtained innovation and equipment is generally designed to support the services' core competency, culture, and requirements. Nevertheless, CINCs have managed to achieve joint success, and this single civilian-led decision may prove to be critical to U.S. transformation.

Finally, it should be noted that joint operations today are extremely complex, so it is difficult for only the most seasoned civilian or ex-military civilian to fully comprehend. Moreover, civilian influence may actually hinder transformation if transformational platforms and products are crowded out of the budget by vested Congressional interests in "traditional" systems or non-transformational acquisition.[24]

The jury is still out on civilian support of the current U.S. transformation, but Congress

(and certainly members of the Executive Branch) are likely to demand substantive changes in the very near future. There are sufficient mechanisms for civilian members of the Department to influence the direction and pace of change, such as the Defense Acquisition Board, Defense Planning Guidance, budgetary reviews, and Departmental regulations. Whether the current administration will exercise its influence remains to be seen.

An Environment or Culture Genuinely Open to New Operational Concepts

The dynamics of military culture, while clearly a critically important variable of transformation,[25] are extremely difficult to judge. For example, there was a tremendous amount of debate between institutions during the most recent 2001 QDR. However, the issues of debate tend to be parochial and more focused towards refinement of existing concepts of operations rather than exploration and consideration of new ones. Unfortunately, the level of debate is noticeably absent within the Services.[26] Additionally, Service and even joint experimentation appears to be focused around the periphery of central enemy capabilities that threaten national security by creating the potential for strategic paralysis.[27]

There has also been only incremental progress in the development of new operational-level concepts of operations, and very few if any have been incorporated into Joint Doctrine. Additionally, the Services have also been reluctant, for the most part, to challenge their current doctrine or seriously challenge each other's core competencies.[28] Nevertheless, the level of experimentation and departures from accepted doctrine in Afghanistan is indicative of an adaptive military genuinely open to change.[29] Based on this evidence, it is difficult to reach a satisfactory conclusion on the Department's military culture and commitment to transform. Where a credible evidentiary-based experimentation process clearly indicated the need for

substantive change, the U.S. military would undoubtedly respond just as the Navy did during the interwar period. Obtaining that credible evidence may be the real challenge.

Extensive Experimentation and Wargaming without a Single Major System Prototype

Each of the Services conduct their own Title X wargames. It is not surprising, nor necessarily undesirable, that each Service wargaming tends to be focused on Service issues and core competencies.[30] Service wargames also tend to be focused on defining Service visions—but as noted before, these visions also tend to reflect the Services' culture and existing core competencies. Visionary concepts such as Admiral Cebrowski's Network Centric Warfare or the networked "Streetfighter" concept usually precede wargaming examination rather than being generated by it.[31] This is exactly the opposite of the way German and U.S. Navy wargamers approached their task in that they were continually searching for what was possible, what was probable, and what was genuinely unexpected.

In terms of addressing pressing national security issues, all of the Services have wargamed projecting military power in an environment where access was denied for political reasons, and against area denial and anti-access capable opponents of varying degrees. Generally, and understandably, there is a tendency of Service game designers to restrict either land or coastal access parochially (i.e., restricting the access of sister Services vice their own).[32] Despite these shortcomings, the Services have wargamed certain advanced concepts. Moreover, JFCOM has conducted several wargames and seminars involving RDO. Therefore, despite certain issues, wargaming within the Department is addressing potentially transforming concepts and operational ideas. However, more could be done to explore what might be possible.

Prospects Within The Current Framework For Experimentation

The two historical case studies of dramatically successful interwar transformation clearly highlight the importance of experimentation firmly grounded in realistic conditions, subjected to detailed analysis, and focused on solving specific problems and exploring operational concepts. Furthermore, all those that failed the interwar challenge had flawed or incomplete frameworks for experimentation. This suggests that military experimentation is the area deserving of *utmost senior leader attention* and sufficient Departmental resources.

Nevertheless, there are some challenges in applying the framework of common characteristics of experimentation programs created by a comparison of the two historical cases to the current state of U.S. military experimentation. First, as has already been highlighted, there are a myriad of organizations and activities within DOD that are engaging in military experimentation; therefore, any general observation will certainly have an exception. Moreover, many of these major efforts are still in their infancy. For example, JFCOM conducts its first large-scale, live-force experiment this year. The first Navy Fleet Battle Experiment (FBE A) was not conducted until spring of 1997.[33] The first Air Force Expeditionary Force Experiment (EFX) was not conducted until 1998.[34] It may be too early to judge how closely current U.S. experimentation conforms to the two historical cases of successful transformation. Nevertheless, there is evidence that today's military experimentation programs have a long way to go to match those of interwar Germany and the U.S. Navy.

Conducted Annually With Available Forces Whose Purpose Is both Training And Experimentation

The one experimentation program that conforms to this historical element of success is the Navy's Fleet Battle Exercises, where experimentation occurs annually during routine fleet

deployments. In every other program, forces that have been fielded have done so exclusively for experimental purposes and outside the Services Title X training programs. The Army created, in effect, an entire experimental division through digitization of the 4th Infantry Division at Fort Hood, Texas.[35] The Army is also in the process of creating the first interim brigade combat teams (IBCTs), but has not yet extensively experimented with this force. Elements of the IBCTs will assemble in support of JFCOMs first live experiment, Millennium Challenge 2002 (MC-02).[36] Similarly, both the Marine Corps' and the Air Forces' live experiments have utilized forces assigned to experiments outside of their Title X training requirements. Problems associated with this approach to experimentation will be explored in Chapter 3.

Strong Institutional and Conceptual Linkages between Wargaming and Exercises

The strongest linkages between wargaming and experiments are found in JFCOM's program where the primary focus has been to develop, mature, and to some extent, validate the RDO concept. Despite some previous linkages, the Army's Transformational Wargames are currently focused on developing the Objective Force concept which, based on its futuristic timeline and ambitious technological requirements, would be extremely difficult (and costly) to link to its experimentation while maintaining real-world grounding. Despite co-location of the Navy's wargaming center, the Navy Warfare Development Center, and the Naval War College, there is little evidence of linkage among these institutions other than at the informal working group level.[37] In a recent change, the NWDC now reports to CINLANT and its focus is being shifted towards near-term issues and "low-hanging fruit." Additionally, the Air Force's EFX program scenarios and objectives have been determined largely in isolation of its wargaming efforts. Again, minimal institutional linkages have been established so those that exist do so informally and usually at a more junior level.

Results Carefully Documented in Reports That Are Widely Circulated

Almost all the Service experimentation programs have complete documentation of the results of their experiments. All of the Service programs have published or made the results available on line. However, based on the number of visits to those sites, it is unclear how widely circulated the results have been, nor is it clear the extent to which they have affected the mainstream of their military competencies. The JFCOM program also has extensive website availability of wargame and "limited objective" experimentation results, but their program is still too new to evaluate using this framework. Given current Congressional reporting requirements, and the certainty of recommendations involving Doctrine, Organizational, Training, Material, Logistical, Personnel, and Facilities (DOTMLPF) stemming from MC 02 results, it is likely to meet this documentation and circulation criteria.

Extensive Senior-Level Involvement (To Include Chiefs/CinCs)

While all the Service and joint programs have senior-level involvement in the planning stages and overall direction of the effort, none has the kind of day-to-day senior-level event involvement that was evident in the historic cases. The experiments have not yet reached a level of interest or imperative that would demand direct three- and four-star involvement in the experiments themselves. This may also be indicative of the lack of perceived urgency in the current U.S. transformational mandate.

Employment Of Live Opposition Forces (Red Teaming) That Frequently Outnumbered "Good Guys"

All of the Department's experimentation programs include live opposition forces and some level of "red teaming," none has done so with the rigor and dynamism as those of the historical cases. For example, JFCOM has insisted that MC 02 involve red teaming and live

opposition forces. The MC 02 opponent is described as a regional power that "may" have "numerically superior forces, home field advantage with asymmetric means, and information operations to attack our will."[38] The problem is that MC 02 is not designed to test the RDO concept itself—the simultaneous non-linear application of joint force offensive effects-based capabilities, but rather the "enablers" of the concept.[39] In its pursuit of RDO through MC 02, and those experimental events leading up to it, JFCOM appears to be honing current processes that already work albeit less effectively than they could—as opposed to genuinely testing a new operational concept. This fact tends to de-emphasize the role of red forces within MC-02, and none of the Services supporting the experiment has made extensive provisions for opposition forces. With the exception of the Marine Corps, virtually none of the current DOD experiments involve red teaming where live forces outnumber good guys in terms of quality or quantity.

Actions Not Scripted And Commanders Faced With Uncertainties As To Opponents' Forces, Capabilities, And Intentions

Unfortunately, many of the live experiments conducted by the Department to date have been conducted more along the French model of providing well-rehearsed demonstrations of capability as opposed to genuine testing of ideas, concepts, doctrine, and equipment. Part of the problem has been that the primary focus of much of the Department's experimentation has been the application of new technologies to refine U.S. command and control systems.[40] This kind of "motive" for experimentation does not easily lend itself to unscripted enemy play, because experiment observers are frequently measuring the response times of various command and control functions.

Comprehensive System To Ensure Experiments As Closely Tied As Possible To The Real World

This is potentially the biggest problem (and opportunity) in the Department's current approach—experimenting in the future against imaginary threats and not addressing real vulnerabilities. For example, JFCOM's first two planned live large-scale experiments involve projected blue and red military capabilities 5 and 15 years into the future respectively.[41] There are several reasons why JFCOM may have chosen this kind of futuristic experimentation. First, given the incredibly complex and time consuming process of acquiring hardware, it is purported to be the only way for experiments to affect future budgets and future acquisitions. Second, experimenting so far into the future eliminates institutional resistance to dramatic doctrinal or organizational departures. Unfortunately, it also necessitates radical departures from the real world and extensive use of surrogates that introduce a host of other variables that would make ascertaining true insights and results difficult. Similarly, the number of variables in experiments must be carefully controlled. This was one of the problems incurred in the Army's 1940 interwar armored division experiments.[42] This futuristic approach may lead to a dramatic decrease in the credibility of experimentation results so critical in overcoming institutional resistance to change. Moreover, this kind of experimentation may result in DOTMLPF recommendations that are at the margins of the current business of the department—implying that the recommendations should wait until the surrogated systems are available in the force at large. Rather than this approach, the historic cases used surrogates on a selective basis and did so in a manner so as to achieve the greatest realism possible under the conditions and circumstances.

Experiments That Fail

Experimentation within the Department has been a relatively expensive enterprise. For example, the Air Force's EFX events have typically cost around $60 million. The JFCOM

sponsored MC 02 event will total over $220 million.[43] While not large percentages in terms of total budgets, senior military leaders have been compelled to have "something to show" for these investments. This fact encourages a more conservative approach to the selection of "motives" and new operational concepts for experimentation, contributing to "experiments" that are really demonstrations of military capabilities.

Concern over failure is also evident in how success is defined. For example, the measures of merit for MC 02 include: "Validation, refinement, modification, and/or revision of the RDO concept."[44] Apparently the possibility that RDO as a new operational concept could "fail" is not being considered. This is consistent with interviews conducted by the author of Service action officers; every Service MC 02 representative already knew the outcome of the experiment. There was simply "no chance of failure." Recall that the French during the interwar years used experimentation to validate their current doctrine.

Notes

[1].-Murray and Watts, 58.

[2].-Department of Defense, *Joint Vision 2010* (Washington, D.C.: U.S. Government Printing Office, 1996), 14.

[3].-Dan Coats, "Joint Experimentation—Unlocking the Promise of the Future." *Joint Forces Quarterly,* Autumn/Winter 1997-98, 13.

[4].-Ultimately the entire implementation effort resulted in the "hand off" to ACOM of 70-some Desired Operational Capabilities that was to inform ACOM's subsequent concept development and experimentation.

Notes

[5].-See U.S. Army, *The Army Vision: Soldiers On Point for the Nation Persuasive in Peace, Invincible in War,* (Washington, D.C.: Government Printing Office, 2000). U.S. Navy, *Forward . . . From the Sea,* (Washington, D.C.: Government Printing Office, 1996). U.S. Air Force, *Global Vigilance, Reach and Power—Air Force Vision 2020,* (Washington D.C.: Government Printing Office, 2001).

[6].-Department of Defense, *Network Centric Warfare,* (Washington, D.C.: Government Printing Office, 27 July 2001), 2-5.

[7].-Admiral William A. Owens, *The Emerging U.S. System-of-Systems*, National Defense University Strategic Forum*,* no.63 (Washington, D.C.: National Defense University, February 1996) 1-4.

[8].-Maj. Gen. David A. Deptula, *Air Force Transformation,* Aerospace Power Chronicles PIREP. (Maxwell AFB, Alabama: Air University Press, Fall 2001), 7-8.

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Chapter 3

Prescription for U.S. Military Transformation and Experimentation

We cannot afford failures in time of war but in peace time, our failure may teach us more than our success.

—Captain C.A. Blakely

Commander, U.S.S. *Lexington*

Institutional Changes

Visions/Visionary Leaders (Persistent Tenure) Driven by Pressing National Security Concern

One of the insights derived from not only this paper's case studies, but other cases as well, is that militaries that lack a specific national security threat to focus upon have more difficulty achieving transformation.[1] While the U.S. faces considerable uncertainty as to when, where, and with whom, our next major high-scale war will occur, the U.S. will likely face some huge strategic and operational challenges when it does occur—even if it came tomorrow. The key is to candidly and completely articulate those current and future challenges, how they might impact National Command Authority options and military responses, and accurately identify our current and projected shortfalls in addressing them. These elements should form the foundations for SecDef, CJCS, JFCOM, and Service visions. In doing so the vision of future capabilities has a rationale, urgency, and clarity to guide the focus of its various organizations and transformational activities. Such visions would also contribute to a culture of openness toward alternative ideas and solutions.

History's lesson is that the documented "tornado" of activity within the Department is

unlikely to produce the kind of military transformation without the overarching guidance and the forcing mechanisms necessary to achieve it. The current CJCS vision seems to have failed in this function. The current QDR 2001 guidance, with its six broad transformational goals is a useful start, but is too general to focus the Department's efforts. The real problem with using the QDR goals is that almost nothing is excluded, ergo, everything is included. The result is insufficient guidance. Additionally, the goals are not prioritized and there have been no assignments to fix responsibility or accountability other than those found in other documents (e.g., the Unified Command Plan and Charter for Joint Experimentation).

What is really needed is for the SecDef to provide top-down guidance sufficient to guide the full range of DOD activities around a well-defined set of at most two or three problems.[2] The idea is to replace a known enemy with a real over-arching challenge or specific set of key challenges. Each of SecDef's transformational goals could be broken down into a logical set of specific challenges. These challenges will be at least at the operational level, and some may even be at the strategic level. Each of these challenges themselves will likely need to be broken down into logical "building block" sub-challenges, utilizing a RAND strategies-to-tasks or similar approach. These sub-challenges could then be assigned to logical offices of primary responsibility for concept development. In this way, SecDef would begin to provide the framework to orchestrate and synchronize the Departments diverse efforts. The SecDef may decide to define the goal of achieving these challenges within a certain time frame to impose some sense of urgency—but at the same time recognize the perils associated with attempting to schedule dramatic changes.

There are several specific operational challenges embodied in SecDef's goals from which to select, the following examples are illustrative: operations in complex terrain such as urban

areas, mountains, and jungles; theater ballistic and cruise missile interception and neutralization (i.e., shooting down missiles after they have been launched); operations in chemical, biological, radiological, or nuclear electromagnetic pulse environments; and space control under a variety of threats.[3] Naturally, all of these operational issues can be found in the QDR 2001 transformational goals. For example, the challenge of theater ballistic and cruise missile interception is part of both the first and third transformational goals (recall that the first is to protect bases of operation at home and abroad and defeat the threat of CBRNE weapons and the third is to protect and sustain U.S. forces in distant anti-access and area-denial environments)—but only a small part of these goals.

By way of example, another overarching and clearly pressing current and future challenge is to develop an effective "counterforce" capability to defeat enemy mobile theater ballistic missile and cruise missile (TBM/CM) systems on the ground. A counterforce capability could be defined as the ability of U.S. forces to conduct offensive operations to neutralize and destroy enemy theater TBM/CM capabilities, associated infrastructure, and command and control, before the enemy is able to effectively launch such weapons in significant numbers. The U.S. military's counterforce effectiveness during Desert Storm was extremely limited, and the number of nations possessing TBM/CMs as well as the number of TBM/CMs in their inventories, has been growing rapidly. Again, the counterforce challenge addresses a portion of at least two QDR transformational goals. Additionally, this challenge is a sub-element of the more comprehensive Air Force Global Strike Task Force concept. Nevertheless, an effective counterforce capability encompasses a number of sub-challenges that go to the heart of a whole series of potentially transformational, critical future capabilities.

The elements of a successful counterforce capability would involve a number of

"building-block" challenges in the areas of intelligence, strike, and command and control. For example, before attacking enemy TBM/CM systems and infrastructure it is obviously critical to know their location, defenses, and posture. This demands a much more robust level of global intelligence (knowledge) than exists today. This intelligence mission requires persistent high-resolution intelligence, surveillance, and reconnaissance (ISR) capabilities in order to monitor system development, movement, and assess enemy capabilities, and requires extensive human intelligence, because high-resolution ISR is not going to provide all the required information. The counterforce mission also demands information accurate enough for targeting decisions involving actual strike system vulnerabilities, system mobility, and a high level of knowledge regarding enemy concepts of operations (CONOPS). Enemy CONOPS and other missile complex characteristics define likely enemy courses of actions (COAs) and employment options as well as indicators of decoys and spoofs. Finally, effective counterforce operations require comprehensive command and control intelligence. While the U.S. will never attain perfect intelligence, the kind of information demanded by the counterforce challenge would require no less than a quantum leap in U.S. intelligence capabilities. Fortunately, the current global strategic situation would enable U.S. intelligence to focus on about five to ten potential adversaries that possess TBM/CMs in significant quantities.

The counterforce challenge also places new and substantive demands on U.S. strike capabilities. Effective counterforce operations demand a substantial number of long-range systems to avoid providing a future adversary with a set of lucrative targets. Strike systems would also have to be highly survivable, as enemies are likely to defend their TBM/CMs and associated infrastructure with the most advanced defenses. This implies some optimal combination of stealth and defense suppression/destruction. Specialized munitions would be

required for hardened and deeply-buried TBM/CM systems.

Effective counterforce operations also demand a high level of patrol and strike persistence. Moreover, relatively short TBM/CM system movement, set up, and launch times, will not afford a reliance on long-range U.S. munitions with lengthy flight times. Thus, counterforce may necessitate specialized unmanned long-loiter systems with some level of survivability or even strike operations from an orbital or sub-orbital platform. These manned or unmanned long-loiter systems may also carry multiple munitions, and U.S. counterforce CONOPS should provide some level of redundancy of strike coverage.

Counterforce operations would also demand a significant expansion of U.S. Special Operations capabilities. Special operations and non-linear ground operations may in fact play a dominant role in counterforce capabilities, especially in providing persistent intelligence and strike functions. Certainly there are challenges to overcome in this realm, such as long-range insertion, long-term sustainability, survivability, and command and control issues.

The joint command and control challenges presented by counterforce operations are huge. First, such a capability would require the Joint Force Commander (JFC) to optimize and rapidly posture the required force elements based on enemy TBM/CM capabilities. The JFC would also have to synchronize force elements over a potentially very large geographic area. Force synchronization also implies a requirement for real-time dynamic (or possibly autonomous) command and control of all elements of the counterforce team. Targeting decisions regarding priority, enemy command, control, communications, computers, and intelligence (C4I), missile systems and their associated infrastructure, and WMD-specific targets are required. Effective counterforce also involves optimizing joint force weapon systems, platforms, munitions, Special Operations, and conduct of non-linear ground operations.

In the course of DOD rising to the counterforce challenge, each of these elements would of course need to be broken down to the next level into sub-building blocks. Sub-building blocks may necessitate a system-of-system type integration, or the multiple grid approach that is informing much of the current Service and joint experimentation and some system acquisition today. SecDef could then define associated metrics and roadmaps for the development of sub-building block capabilities. Developing a genuine U.S. counterforce capability will involve solving a series of sub-challenges, it will take time, and require persistence of leadership and effort. The key is for SecDef to focus and orchestrate disparate DOD activities around a specific set of critical operational problems.

Service Visions

The Army's current vision is focused on greater strategic mobility, increased responsiveness, and creation of a "middle weight" wheeled force.[4] While this appears to be in part a short-sighted reaction to Task Force Hawk, and many smaller-scale, low-threat contingencies that has characterized Army deployments over the past decade or so, the Army has struggled with creating a rapidly strategically deployable force capable of decisive force for decades.[5] The Army's vision of transformation appears to ignore immutable truths and likely changes in future warfare. It would be improbable to deploy even five objective force divisions in 30 days without considerable in-theater infrastructure and ports of debarkation. Moreover, such a concentration of soldiers and resources are likely to be the targets of future WMD-equipped adversaries armed with accurate ballistic and cruise missiles, suicide bombers, and terrorist/special operations cells. Similar concentrations of maneuver forces within the ever-expanding and increasingly lethal battlespace of the future will be at greater risk.

By addressing these challenges head on, the Army's vision could proactively address the

ability to project and sustain long-range power projection. This may involve integrating units operating in diverse widespread locations with fundamentally different organizations than the current brigade/division/corps. These new units could possess advanced special operations-like capabilities—with even greater lethality, dramatically expanded ranges and effects to achieve a truly long-range precision strike capability.[6] When these new ground forces are equipped with dramatically improved Army and joint C4ISR, with a relevant combined operational picture through integration of a host of advanced sensors (ground, air, and space), the result could be the development of much greater capabilities to control large areas (or evict from critical ones) in a range of complex environments (urban, mountainous, and jungle).[7] Nevertheless, it is important to note that transformation probably won't necessarily mean the end of heavy mechanized combined arms warfare or air-land battle capabilities—but the fundamental conduct of the struggle will have undoubtedly been altered.

Naval visions (Forward From the Sea and Operational Maneuver From the Sea) generally suffer from the same kind of strategic denial as the Army's vision in its failure to come to terms with the increased lethality (and thus their own vulnerability) of the current and future littoral/amphibious environments. To its credit, the Navy has incorporated an "Assured Access" component as part of its Network Centric Operations capstone concept. It has also included anti-access capabilities into its Fleet Battle Experiment program—but has fallen short of fully exploring more longer-term, "out-of-the-box" solutions like arsenal ship, Streetfighter, and new hull designs.[8] Navy exploration of other means of long-range strike, counter-mine and advanced counter-sub operations (especially in the littoral environment), and the employment of fast ships are encouraging.

The Air Force vision would be greatly improved if it were to incorporate more fully all the elements of the Global Strike Task Force concept and articulate specific steps that will lead to the full integration of air and space. The Air Force should also look to explore more fully the potential of unmanned aircraft, particularly aircraft whose parameters could be dramatically expanded once freed of the need to maintain human life—such as G-tolerance, size, and loitering capability. The real issue is not replacing the man-in-the-cockpit, but rather augmenting manned air-to-air and air-to-ground capabilities. Imagine the possibilities of manned fighters armed with unmanned ground-attack wingmen capable of sustained supersonic speed, stealth, and 40-G tolerance sufficient to out-maneuver advanced SAMs. Based on the results of several wargames, the Air Force vision will ultimately have to more fully develop space control concepts of operations and be prepared to execute them.[9]

Finally, the Department should heed the recommendation of many critics (and certainly supported by many historic case studies) by making special provisions to provide for greater tenure for key positions within the transformational process. Positions should include CINCJFCOM, JFCOM J-9, Vice CJCS, key members of the JCS staffs, USD(P), and the Director of Transformation.

Detailed, Systematic Study And Analysis Of Experiments And Military Thinking Of Others

This paper and other historic studies have documented the critical role played by the transformational activities of other nations (particularly Britain) in the success of German combined armored maneuver warfare and U.S. Navy air carrier operations. Just as before, other militaries today are, and will continue to be, attempting to exploit and integrate many of the same technologies and capabilities that are available to the U.S. military. This was, and is, the

interwar challenge. The ways in which both friendly and potentially hostile militaries integrate these technologies can also provide a means to "red team" U.S. transformational directions. Similarly, there is no doubt that others will continue to look to U.S. experimentation and concept development to inform their own transformational efforts. The Department definitely has a stake in the transformations of others.

Future operations will almost surely be conducted within the context of at least one, and probably multiple, coalition partners. Just as the innovations, experimental insights, and operational concepts and direction of others is important to U.S. efforts, a free exchange will help to ensure likely coalition members will develop similar transformational capabilities. Foreign participation in U.S. wargames, field exercises (experiments), and concept development activities is critical to this process. Similarly, the Department should resource reciprocal U.S. involvement in foreign activities as a means to foster expanded interoperability. To its credit, JFCOM has made provisions for foreign observation of joint force headquarters functions during MC 02 and its Multinational Concept Development and Experimentation Center is a laudable start, but this area deserves consideration for much greater resources.[10]

Transformational activities of potential foes should be closely monitored and will assist in the refinement of U.S. transformation. Clearly more research and translated articles need to appear in today's professional journals. This can only be achieved by focusing resources to translate and publish the burgeoning amount of unclassified articles, think pieces, and exchanges that are being developed world-wide. This effort could include those of non-state organizations (within classification boundaries). The Department may wish to follow the German General Staff lead and publish a separate journal devoted to the advanced concepts, experiments, and operational thinking of others.

Decades To Develop (Recognition That It Will Take Time)

The Department and civilian leaders need to be mindful of the potential pitfalls of rushing to judgment on the direction of U.S. transformation. JFCOM is currently under substantial Congressional pressure to recommend significant DOTMLPF changes in order to maintain funding and "keep the job." In doing so however, the Department may fall into the trap of single-event, experiment-driven "solutions" that may ultimately prove to be counterproductive. In order to maintain the integrity and credibility of the process, substantive JFCOM DOTMLPF recommendations must be thoroughly tested and sufficiently mature. Evidentiary-based testing and development should eventually lead to adoption and implementation, and just as in the historical cases, it should overcome institutional resistance. There is also the danger of premature lock-in. Adaptability and strategic flexibility (agility) going forward should guide the transformation. Given the magnitude and scope of U.S. conventional dominance and resources, the Department can afford to hedge.

At Least A Modicum Of Outside (Civilian) Influence and Assistance

No doubt Congress will be a key player in the upcoming transformation, just as it was in the U.S. Navy's case. But senior military transformation leaders must be wary of the dangers of vested Congressional interests obstructing transformation in non-transformational weapon systems acquisition and in the maintenance of excessive infrastructure. Moreover, Congress may resist Departmental acquisition reform and pursuit of spiral development in an attempt to continue to minimize technical risks at the expense of delays in fielding prototypes and getting on with the process of doctrinal, organizational, and technical discovery. Robust and compelling experimentation results are the key to overcoming Congressional resistance, but the results must be credible.

SecDef should empower newly-created civilian organizations and strengthen their role in the transformation process. SecDef has presented the Director of Transformation with a monumental challenge, especially in light of a relatively small-staffed office. The single director's current authority over the process is derived solely through its association with SecDef. One way to empower the Director of Transformation would be the creation of a "Bishop's fund." The Director currently has a budget of around $20 million.[11] If SecDef were to increase that amount significantly, it would augment the Director's authority and ensure him a seat at the transformational table without granting specific authority to the office. The Director could then use the money to force the "invisible hand" of inter-Service rivalry by having the Services compete for transformational funding in solving pressing national security issues and responding to the SecDef vision. It would also provide the means of ensuring that the Director's perspective and seeds of insight are appropriately developed and tested.

An Environment Or Culture Genuinely Open To New Operational Concepts

Several recommendations contained in this report would ultimately contribute to a more transformational environment or military culture. For example, creating SecDef, CJCS, Service, and CINC visions that genuinely define challenges would create a sense of urgency and force exploration of alternative solutions. Similarly, greater emphasis on the transformational ideas and efforts of others should lead to more dynamic conceptual environment. Increased civilian involvement and lengthened tenure in key transformational positions (visionary persistence) would also stimulate competition among the key players and provide pathways for innovative junior officers to senior positions. Finally, greater linkages between experimentation and wargaming among competing organizations will lead to more robust process of exchanging ideas and testing them. The evidence of the historic cases suggests that experimentation is the key to

success.

Prescription for Military Experimentation

Nature of Experimentation

War is an incredibly complex phenomenon. It owes its complexity to the fact that it is a uniquely human endeavor. As a result, Clauswitz reminds us that understanding war's conduct cannot be reduced to scientific methodology. The dynamics of the multi-faceted nature of variability of complex phenomena could be graphed along a notional continuum beginning with lab testing, modeling and simulations, wargaming, limited-objective live force experiments, large-scale live experiments, and war (see figure 1). The greater the human element, the greater the complexity. At its extreme, war involves interaction between opposing forces which, according to Clausewitz, the "…very nature of interaction is bound to make it unpredictable." While it is possible to capture some random actions in models and simulations, violent human interactions of that are non-linear and chaotic in character will continue to limit the utility of modeling in experimentation (especially at the operational level). All these factors underscore the historic cases' emphasis on the value of live, unscripted, and large force-on-force exercises for experimentation.

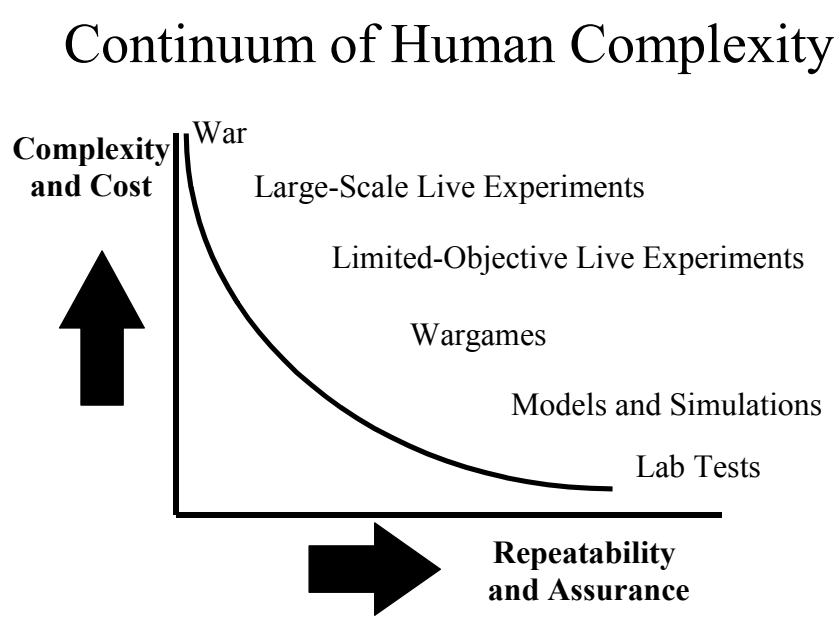

Figure 1

Figure 1 also highlights that military experimentation cannot be reduced to the hypothesis testing associated with scientific inquiry.[12] Doing so rejects most methods of the knowledge acquisition and discovery phases of scientific inquiry, as well as the majority of the styles of research.[13] Nevertheless it is exactly the unfortunate approach used in most joint experimentation. For example, MC 02 is centered on the following single hypothesis:

If a standing Joint Force Headquarters is informed by an Operational Net Assessment and employs Effects Based Operations which utilize the full range of our national capabilities;

then the 2007 Joint Force will be able to conduct Rapid Decisive Operations (RDO) against a determined 2007 adversary.[14]

During the interwar years, both the German Army and U.S. Navy employed a complex but rigorous overarching framework for conducting experimentation to determine *what worked and what did not work* under conditions that were as closely connected to the real world as possible. Yet, despite the similarities to this interwar period, the Department today has no

overarching framework for conducting experimentation. A CINC JFCOM has been designated to conduct joint experimentation, and most recently stripped of its geographical responsibilities (both were suggested by the National Defense Panal), but the JFCOM's Charter for Joint Experimentation does not define nor does it delineate specifically how joint experimentation is to be conducted. Joint Forces Command and even the Services are free to experiment however they desire.

The primary problem with this amorphous approach is that military experiments don't occur in an institutional vacuum. Consequently, human perceptions and agendas can tarnish the process. It may be possible to design experiments and conduct "experimentation" in such a manner as to "prove" practically anything.[15] This is especially true as one moves farther and farther from the real world into some kind of mythical or hypothetical future world.

Extensive Experimentation And Wargaming Without Single Major System Component Prototype

As illustrated by the historic interwar cases, the purpose of wargaming is to explore out-of-the-box scenarios, weapon systems, and concepts of operations within a real world context. The objectives of wargaming are to ask better questions, gain critical insights, and provide alternative solutions. The Service-centric nature of Title X gaming can be positive, but the "invisible hand" of inter-Service rivalry could be strengthened by institutional cross-flows among each of the gaming centers of each other's results. The end product would be a structured critique of the inputs and outputs of each other games that would force an increase the dialogue and mutual understanding as well as increased self-discipline of the entire process including self-critiques of the conclusions/results. JFCOM wargaming should be subject to the same rigorous institutional process as the Title X games.

Just as in the historical cases, DOD needs to provide for direct institutional linkages to field and fleet exercises. Wargaming should incorporate the latest experimental data, and be used to analyze and re-examine results, explore operational and tactical alternatives, and identify "motives" for future experiments. This is similar to the Model-Experiment-Model approach but adds the dynamics and discipline of manned wargamers to the process.

Extremely Realistic Experimentation Grounded In Detailed Analysis And Focused On Solving Specific Problems And Exploring Operational Concepts

Given its central role in the transformation process, and given the diversity and number of experimentation activities and organization within the Department, this issue warrants the issuance of a DOD regulation that would establish SecDef policy for governing all large-scale joint and Service experimentation. The key to unlocking future U.S. military capabilities during this interwar period, just as in the last one, is the development of a robust experimentation regime. Fortunately, our forefathers have provided a rich legacy to adapt and exploit. While the previous interwar period was fixed in industrial-age platforms, the principles and processes of experimentation they developed and refined are equally relevant to today's information age technology.

The proposed DOD regulation would use the successful U.S. Navy (and Joint Army Navy Board) Fleet Problem process as the template to structure an end-to-end experimentation program designed to challenge current military doctrine and explore new operational concepts to overcome real world problems; evaluate the strengths and weaknesses of current weapon systems and organizations; and deliver empirical evidence with sufficient credibility to drive future doctrine, training, organizational arrangements, acquisition priorities, and budgets that will set the course for a quantum leap in U.S. military capabilities.

The proposed DOD regulation would include the major characteristics found in the comparison of the historic case studies. The DOD directive would include provisions for large-scale force-on-force JFCOM experiments conducted at least *annually* (preferably two per year) with available forces (e.g., forces already scheduled to participate in training) whose purpose is both training and experimentation. Under this approach, current readiness will suffer to some extent. There will always be a tension between current readiness and adequately preparing for the future. But if there is indeed a strategic pause in the global security environment, the U.S. military can afford to turn large scale Service (National Training Center, Red/Green Flags, Fleet Work Ups) and CINC training events into joint exercises whose *primary* purpose is joint experimentation. Moreover, just as in the historic cases, it is still possible to conduct a great deal of Title X training within the context of a large-scale experiments. The U.S. Navy modified Umpire Instructions to ensure forces were not "killed" in the first few days of the Fleet Problem.[16]

There are several advantages to this historically based approach to manning and funding experiments. First, it avoids the need to establish standing experimentation forces. The forces are already subject to a high operations tempo and can ill afford unnecessary additional burdens. Second, the use of forces dedicated to experimentation lacks credibility. The perception is one of a "silver bullet" force that is disconnected with the military at large, and is subject to the so-called "Hawthorne effect."[17] Third, the experiments lose the dynamics associated with multiple perspectives on operational/tactical issues that enriched both historic cases' innovative processes.

The U.S. military currently conducts approximately eight to ten medium- to large-scale joint exercises per year. These exercise locations generally cover the full gamut of battlespace

terrain and infrastructure development. It is certainly important to link the Western training ranges with sufficient interneted instrumentation and bandwidth to facilitate joint training and experimentation.[18] Also the Department's commitment to creating a joint National Training Center is another important step toward effective and efficient experimentation.[19] Given the potential future uncertainties and operating environments, it is important that U.S. experimentation involving new operational concepts, equipment, doctrine, and organizations are able to be tested utilizing the full gamut of global exercises available. The Services routinely deploy forces to accomplish scheduled joint training and also use these global joint events as a vehicle to accomplish Title X training. Certainly, as the Department re-balances its current and future readiness priorities, JFCOM should be able to leverage one larger-scale joint exercise or one Title X event, or both, for experimentation annually.

While modeling and simulation may play critical role in developing insights and lowering costs—there are still *major* problems with DOD modeling and simulation capabilities. Insights derived from modeling or simulation will lack sufficient credibility within the joint community to result in significant change. The bottom line is that there is simply no substitute for the live free play of forces within the experimentation process.

In addition to wargaming recommendations made earlier, the DOD regulation would provide for direct linkages between wargaming and experimentation. Experimentation results should feed into wargaming and vice versa. Just as Germany and the U.S. Navy demonstrated, wargaming should be used to develop conceptual insights to be tested in the field.

The DOD regulation would also require complete documentation in reports that are widely circulated. A requirement for SecDef, CINC, Service Chief, and War College President-level coordination throughout DOD would ensure widest dissemination of annual experiment

"motives," experiment summaries, and commander critique sessions. Wide circulation would also help foster an environment or military culture genuinely open to change.

Another critical element of the DOD regulation, would be a fully developed, comprehensive system to ensure experiments that are tied as closely as possible to the real world. Experimentation would not occur in the context of some future mythical world. The DOD regulation would prescribe extensive use of an umpire system. Like the old German and Navy system, each annual experiment would be governed by a detailed set of Joint Umpire Instructions. The rules would be based on the most accurate experimental (live) data available. These rules would be extensively coordinated to ensure accuracy, and designed to achieve greatest realism and to best approximate the results in wartime.

Just as in the Navy system, extensive senior-level involvement (to include Chiefs/CINCs) would take the form of head umpires in annual joint field/fleet exercises. CINC JFCOM should act as head umpire and each Service should appoint a four-star commander to act as a Forces umpire with a subordinate set of lesser ranking umpires. The DOD regulation may elect to have DepSecDef involved in the commander's post-exercise/experiment debriefs. SecDef may also consider appointing the Director of Transformation as the senior ranking civilian on an umpire instruction committee, as well as ensuring appropriate Service representation. Similarly, a "motives" board to prioritize the focus of experimentation may also be chaired by the Director for Transformation. The OSD staff, CJCS, Services, and the JFCOM staff should all be able to nominate motives for prioritization.

Another key element within the DOD regulation would be the provision for extensive live unscripted force-on-force play. This kind of joint exercise is arguably outstanding training in its own right. The Navy used the "quick-decision" commander's estimate within the Fleet

Problems to afford commanders on "both sides" with decision-making experience under the most realistic conditions possible.

Each joint field/fleet exercise would involve the employment of live opposition forces (red teaming) that frequently outnumbered "good guys." This would not only provide realistic training for commanders, but would also enable testing operational concepts to the breaking point. Consistent with experimentation grounded in the real world, the commanders should not (usually) know opposing force posture, locations, capabilities, and intentions. Thus, these exercises would include some level of fog and friction—with real adaptive forces on both sides—designed to test integration of sensors and intelligence capabilities (if one of the motives), test systems for vulnerabilities, test alternative C4 structures, and determine what systems work, what systems need improvement, and what systems should be scrapped.[20] It is also important that motives violate current doctrine, and not experiment around the periphery of vested institutional issues.

The DOD regulation would adopt measures of merit for experimentation that would enable failure. Measures of merit from the experimentation should stress how much is learned vice whether a certain concept was validated or refined.[21] Experimentation is a process of discovery. As discoveries are made, and sufficiently validated, DOTMLPF changes will result through existing JCS processes provided senior leaders have been involved throughout the process and the results have credibility.

Finally, there should be established linkages between experimentation and the acquisition process. Much has been written about strengthening JFCOM's role in the acquisition process; the specific mechanisms to increase JFCOM's role in the process is beyond the scope of this paper. Nevertheless, SecDef may decide to include some additional linkages in the

experimentation directive, even beyond those currently prescribed in the Joint Implementation Master Plan.[22]

The current interwar period is one of tremendous uncertainty with many similarities to the last such interwar period. Historic cases highlight need for genuine discovery of what works and what does not. The only way to accurately and credibly make such determinations is through multiple runs of realistic trials with live forces under a variety of conditions. Motives for experimentation should be guided by SecDef vision (specific prioritized operational challenges and sub-challenges) with direct linkages to wargaming. Experimentation should include structured senior-level involvement. Given the importance of experimentation, it needs to be accorded sufficient resources,[23] even if it means some reduction in the current readiness of forces. The Department is already 12 years into the current interwar period—it is time to put in place a proven process for experimentation and framework for genuine transformation.

Notes

[1].-Murray, *Thinking About Innovation*, 58-62.

[2].-For an excellent discussion see Hundley, 22-28.

Also see DSB report which called for an explicit transformation strategy, roadmap, and metrics to assess progress. Also see Paul K. Davis, James H. Bigelow, and Jimmie McEver, *Analytical Methods for Studies and Experiments on "Transforming the Force,*" D.B.-278-OSD, National Defense Institute, (Santa Monica, C.A.: RAND, 1999) vii.

[3].-This list is not meant to be exhaustive—DPG challenges and others could be used but the key is for SecDef to embrace the most overarching and important ones with the greatest promise

to force potentially transformational change.

[4].-Army Vision, 3.

[5].-David Jablonsky, Army Transformation: "A Tale of Two Doctrines," *Parameters U.S. Army War College Quarterly,* Autumn 2001, p.45.

[6].-Andrew F. Krepinevich, *W(h)ither the Army?,* (Washington, D.C.: Center for Strategic and Budgetary Assessments, January 2000), 2-3.

[7].-Ibid., 4.

[8].-United States General Accounting Office, *Military Transformation—Navy Efforts Should Be More Integrated and Focused,* 7.

[9].-Haffa and Patton, *Wargames*, 4.

[10].-MC 02 Report from the Secretary of Defense to Congress, 4.

[11].-Keller, 9.

[12].-Robert Worley, *Defining Military Experiments - What Does "Military Experimentation" Really Mean?* IDA Document D-2412 (Alexandria, V.A.: Institute for Defense Analyses, February 1999), 4.

[13].-Ibid., 5.

[14].-Report of Joint Forces Command, "JFCOM Experiment Analysis Plan, Millennium Challenge 2002," 2.

[15].-Herwig, 72, for example where The Kaiser "proved" the superiority of cavalry lance over machine guns and mortar.

[16].-U.S. Fleet *Umpire Instructions*,1.

Notes

[17].-The term Hawthorne effect was derived from a management experiment at the Hawthorne factory where the participants increased productivity under a series of variables during the course of the experiment but eventually returned to normal once it was over.

[18].-Department of Defense Report to Congress, *Millennium Challenge 2002 Joint Experimentation Initiative,* 4-8.

[19].-Senate, *Military Transformation: Hearings before Senate Armed Services Committee,* 10.

[20].-Coats, 15-19.

[21].-Report of Joint Forces Command, "JFCOM Experiment Analysis Plan, Millennium Challenge 2002," Version 3.3, 2.

[22].-Chairman Joint Chief of Staff Instruction 3010.02 *Joint Vision Implementation Master Plan* (JIMP), 15 April 2001, A16-A22.

[23].-Krepinevich, Lighting the Path Ahead, 27-33.

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